LEAR
LNC-100

LEAK - LNC-100

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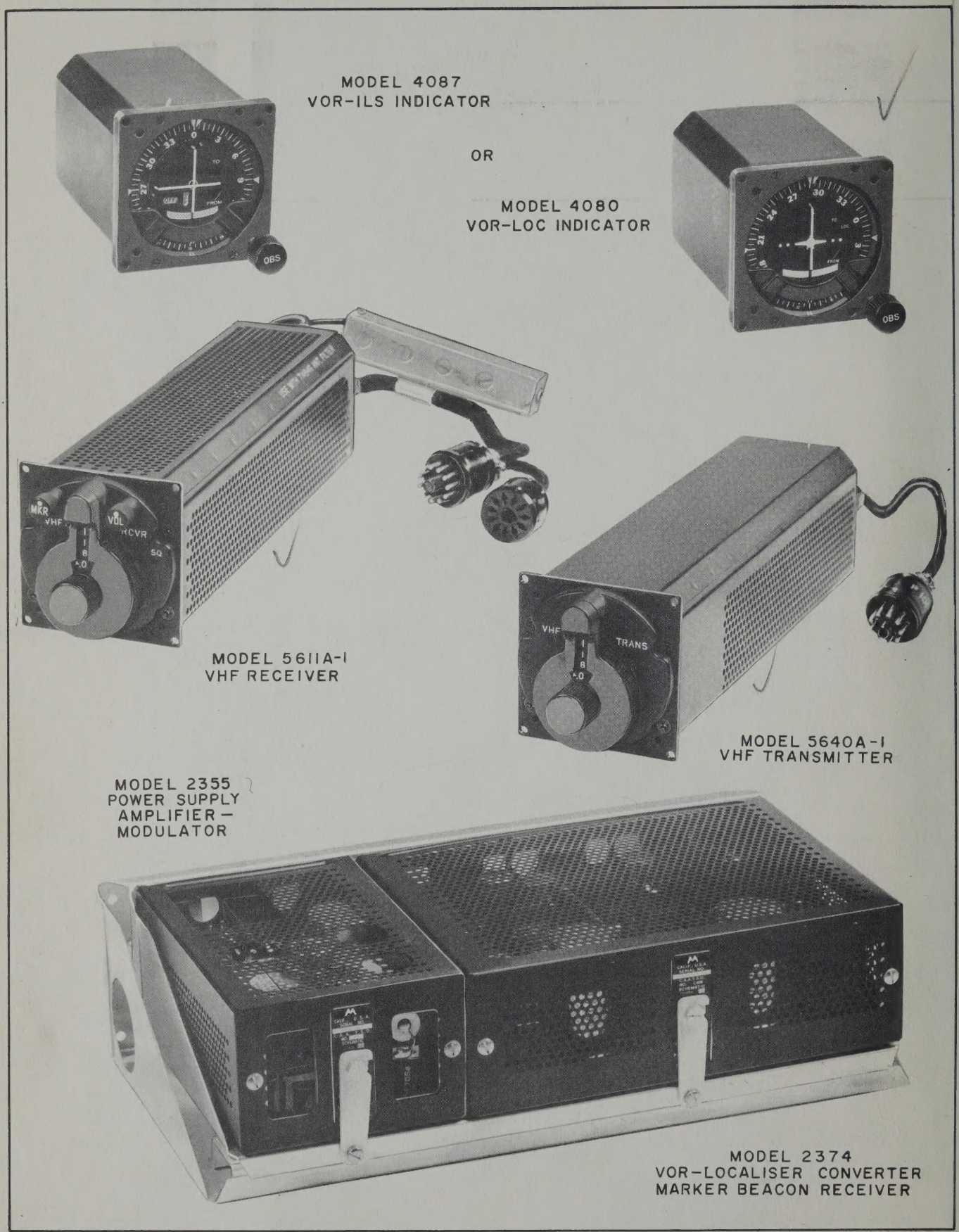

Figure 1-1. Components of LNC-100 System

SECTION I

FUNCTION AND DESCRIPTION

1.1 GENERAL

The LNC-100 System is a comprehensive aircraft vhf radio communication and navigation system consisting, in its standard form, of the integrated assembly of five compact modular units as shown in Figure 1-1. The assigned nomenclature of the five principal units and their abbreviated nomenclature for reference in the text are listed in Table 1-1.

1.2 PURPOSE OF EQUIPMENT

The functions of the LNC-100 System are to provide receiving and transmitting facilities for vhf voice communication; and receiving facilities for VOR (omni-range) signals, ILS-localizer signals, and 75-mc marker-beacon signals.

1.3 SYSTEM CONFIGURATIONS

The LNC-100 System is available in the configurations listed in Table 1-2.

a. The LNC-100A provides a two-way vhf communication system.

b. The LNC-100B provides a two-way vhf communication system plus reception facilities for VOR, localizer, and marker-beacon signals.

c. The LNC-100C provides a two-way vhf communication system plus VOR, ILS (localizer and glide-slope), and marker-beacon signals.

d. The LNC-100D is a dual LNC-100B system.

1.4 DESCRIPTION OF PRINCIPAL COMPONENTS

1.4.1 Model 5640A VHF Transmitter

The 5640A module consists of two crystal-controlled oscillators, a mixer stage, a driver stage, and a final output power amplifier. Plate modulation is provided by the three-stage amplifier-modulator section of the Model 2355 module. When operating over its maximum range the transmitter contains 34 crystals and covers a frequency range of 118.00 to 131.95 in 280 discrete twentieth-megacycle steps. Frequency selection is accomplished by two rotary ganged switches, mounted concentrically, and controlled by the megacycle and fractional-megacycle control knobs on the front panel of the transmitter. The megacycle control knob (large outer knob) selects the desired number of megacycles; the fractional-megacycle control knob (small inner knob) the desired number of fractional megacycles. The transmitter utilizes ruggedized vacuum tubes for long life and employs etched circuitry throughout. All components are integral to the etched circuit board, which is mounted on the chassis frame and enclosed by a perforated cover. The unit is of single-package construction and mounts directly on the aircraft instrument panel.

1.4.2 Model 5611A VHF Receiver

The model 5611A module is a crystal-controlled receiver that employs a double-conversion superheterodyne process to convert the incoming vhf signal to a fixed-intermediate frequency of 3.1 mc. The receiver covers the frequency range of 108.00 to 130.90 mc in 230 discrete tenth-megacycle steps. Frequency selection is accomplished by the megacycle and tenth-megacycle control knobs which are mounted concentrically on the front panel of the receiver. The circuits include delayed automatic volume control, transient noise limiting, and variable automatic squelch. Two audio-output circuits are provided; one, through a stage of audio amplification for voice communication signals, the other, through a cathode-follower for navigation (VOR-ILS) signals. The megacycle and tenth-megacycle control knobs automatically actuate the required VOR-localizer equipment

TABLE 1-1

ASSIGNED NOMENCLATURE	REFERENCE NOMENCLATURE
MODEL 5611A VHF RECEIVER	Model 5611A module
MODEL 5640A VHF TRANSMITTER	Model 5640A module
MODEL 2374 VOR-LOCALIZER-MARKER BEACON RECEIVER	Model 2374 module
MODEL 4080A VOR-LOCALIZER INDICATOR or MODEL 4087A VOR-ILS INDICATOR	Model 4080A navigation indicator or Model 4087A navigation indicator
MODEL 2355 POWER SUPPLY, AMPLIFIER, MODULATOR	Model 2355 module

TABLE 1-2

SYSTEM CONFIGURATIONS

SYSTEM DESIGNATION	INCLUDES
LNC-100A	Model 5611A module
	Model 5640A module
	Model 2355 module
LNC-100B	Model 5611A module
	Model 5640A module
	Model 2355 module
	Model 2374 module
	Model 4080A navigation indicator
LNC-100C	Model 5611A module
	Model 5640A module
	Model 2355 module
	Model 2374 module
	Model 4087A navigation indicator
	Model 5607D glideslope receiver
LNC-100D	Dual LNC-100B System

and/or glideslope receiver channel when the appropriate navigational frequency is selected for reception. The unit employs etched circuitry throughout. All components are integral to the etched circuit board, which is mounted on the chassis frame and enclosed by a perforated cover. The receiver is of single-package construction and mounts directly in the aircraft instrument panel. The volume control and the squelch control are mounted on the front panel of the receiver in addition to the two frequency-control knobs. For simplicity of system operation the sensitivity control of the marker-beacon receiver section of the Model 2374 module is also mounted on the front panel of the vhf receiver, but has no circuit connection with the receiver.

1.4.3 Model 2374 VOR-Localizer-Marker Beacon Receiver

The Model 2374 module is the "navigating brain" of the LNC-100 System. When operated in conjunction with the Model 5611A module and the Model 4080A or 4087A navigation indicator it provides a complete VOR facility for en-route navigation and a localizer facility for airport instrument approach purposes. In addition, the Model 2374 module contains the 75-mc marker-beacon receiver. The VOR converter, the localizer converter, and the marker-beacon receiver, although combined in a single package, are completely separate from each other in principle of operation.

a. VOR Converter

The VOR converter consists of a dual-channel amplifier feeding into a phase-sensitive demodulator. One channel, referred to as the "Reference Channel," amplifies, detects, and demodulates the 30-cps frequency-modulated 9960-cps subcarrier, and provides the reference input to the demodulator.

The other channel, referred to as the "Variable Channel," amplifies and recovers the 30-cps amplitude-modulation envelope from the 9960-cps subcarrier to provide the variable-phase input signal to the ring demodulator. The difference in phase between the reference and variable signals is a measure of the radial bearing of the aircraft with respect to the VOR transmitter.

The demodulator compares and measures the difference in phase between the reference and and variable signals to produce a d-c output voltage that is proportional in magnitude and polarity to this phase difference. This d-c voltage actuates the vertical right-left pointer in the Model 4080A or 4087B navigation indicator to give an indication of the amount and direction of the deviation of the aircraft from a preselected radial.

b. Localizer Converter

The localizer converter consists of an amplifier-detector circuit that converts a composite 90- and 150-cps input signal into two d-c output voltages that are proportional in magnitude to the relative amplitudes of the 90- and 150-cps components of the composite signal. This d-c voltage actuates the vertical right-left pointer in the Model 4080A or 4087B navigation indicator to provide an indication of right-left horizontal deviation of the aircraft from the centerline of approach to the runway.

c. 75MC MARKER-BEACON Receiver

The marker-beacon receiver consists of a three-stage tuned r-f receiver. It is designed to receive and demodulate the 400-, 1300-, and 3000-cps audio-modulated r-f transmissions from the outer, middle, and airway beacon transmitters respectively. Audio output from the marker-beacon receiver is further amplified by the audio-power amplifier located in the Model 2355 module for aural reproduction in a headset or loudspeaker.

The functions described in the three preceding paragraphs are included in a single compact unit. All components are mounted on an etched circuit board which is enclosed in a perforated cover. The complete module is installed on a vibration-free shock-mount. The Model 4080A or 4087A navigation indicator is automatically switched from localizer operation when the vhf receiver is tuned to a VOR channel.

1.4.4 Model 2355 Power Supply-Amplifier-Modulator

The Model 2355 module also combines three functions in a single package. It consists essentially

TABLE 1-3. LNC-100 SYSTEM EQUIPMENT LIST

SYSTEM COMBINATION				COMPONENT	MODEL OR PART NUMBER
A	B	C	D		
1	1	1	2	VHF Receiver, 14 or 28 vdc	5611A
1	1	1	2	VHF Transmitter, 14 or 28vdc	5460A
1	1	1	2	Power Supply-Audio Amplifier-Modulator	
				14 vdc, without surge protector	2355A
				28 vdc, without surge protector	2355B
				14 vdc, with surge protector	2355C
				28 vdc, with surge protector	2355D
	1	1	2	VOR-Localizer Converter-Marker Beacon Receiver	
				14 vdc, without lamp amplifier circuit	2374A-1
				28 vdc, without lamp amplifier circuit	2374B-1
				14 vdc, with lamp amplifier circuit	2374C-1
				28 vdc, with lamp amplifier circuit	2374D-1
	1		2	VOR-Localizer Indicator	4080A
		1		VOR-ILS Indicator	4087A
		1		Glideslope Receiver, 14 or 28 vdc	
				14 or 28 vdc, without power supply	5607D
				With 14 vdc power supply	5607E
				With 28 vdc power supply	5607F
1				Shockmount (half size)	714010
		1		Shockmount (full size)	714591
	1	1	2	Shockmount (1-1/2 size)	714009
2	2	2	4	Bracket Mounting Kit (used when Transmitter and Receiver are mounted on non-shockmounted instrument panel; bracket is not supplied)	714390
1	1	2	2	Circuit Breaker, or Switch and Fuse, 14 or 28 vdc	------
1	1	1	2	Carbon Microphone, 100 ohms nominal	------
1	1	1	2	Loudspeaker, 3.2 ohms	------
	1	1	2	Marker Beacon Light (used with 2374C, D only)	96827-01 (socket) 96429 (lamp)
1	1	1	2	High Pass Filter	714946
2	1	1	2	*VHF Whip Antenna	63851
2	1	1	2	*Whip Antenna Connector	PL-259
	1	1		VOR-Localizer Antenna	63707
	1	1		75MC Marker Beacon Antenna	97971
		1		Glideslope Antenna	-----
1	1	1	2	J-101 (VHF Transmitter)	Amphenol 78-S9
2	2	2	4	P-102, P201 (Transmitter and Receiver Antenna)	Cinch-Jones 13B
1	1	1	2	P-203 (VHF Receiver)	Amphenol 78-S11
1	1	1	2	P-202 (VHF Receiver)	Amphenol 86-CP11
1	1	1	2	J-301 (Power Supply-Audio Amplifier-Modulator)	Cannon DX2252-1WO
	1	1	2	J-401 (VOR-Localizer Converter-Marker Beacon Receiver)	Cannon DX2842-1VO
		1		J-501 (Glideslope Receiver)	Cannon DX2842-1MO
	1	1	2	J-601, J-701 (4080A and 4087A Indicators)	Cannon SK19-21C-1/2
3	3	3	6	Connector shell (used with J-101, J-203, and P-202)	Amphenol 3-24
As Required				Interconnecting Cable	------

* The VHF antenna arrangement most often used for single engine aircraft consists of two separate antennas -- one for transmitting and one for receiving. With no navigational provision, two whips are usually employed. With VOR-Localizer equipment installed, a navigation antenna used for both communication and VOR-localizer reception is combined with a transmitting whip. The use of one whip antenna switch by a T-R relay is generally not recommended. Other possible antenna installations use the following components in place of the whip(s) above.

1	1	1		VHF Broadband Antenna	2217A
1	2	2		Antenna Switching Relay 14 or 28v	63339-01/02
3	6	6		Antenna Relay Connectors	Amphenol 83-776
1	1	1		Broadband Antenna Connector	UG-58/U

TABLE 1-4. MODULE DIMENSIONS AND WEIGHTS

MODULE MODEL	OVERALL DIMENSIONS (in.)	WEIGHT (lb)
5611A	3.25 x 3.25 x 14.5 approximately, including connector clearance	3.0
5640A	3.25 x 3.25 x 11.0 approximately, including connector clearance	2.6
2355	3 x 4.7 x 7.75 approximately, including connector clearance	2.25
2374	3 x 7.75 x 9.5 approximately, including connector clearance	4.6
4080A	3.25 x 3.25 x 5.5 approximately, including connector clearance; less knob	1.2
4087A	3.25 x 3.25 x 5.5 approximately, including connector clearance; less knob	1.5
5607	3 x 7.75 x 9.5 approximately, including connector clearance	4.3

of a dual-purpose three-stage audio power amplifier together with a saturable reactor-transistor type power supply that provides primary power to the entire LNC-100 System.

A five-pole double-throw transmit-receive relay determines the function of the amplifier. In the transmit position the amplifier serves as a speech-amplifier plate-modulator for the vhf transmitter. In the receive position it functions as an audio power amplifier for the marker-beacon and vhf receivers.

The saturable reactor-transistor power supply eliminates any vibrating or rotating equipment in the d-c to a-c converter and provides a highly efficient performance-to-weight ratio. The amplifier-modulator utilizes ruggedized vacuum tubes for long life and high power operation, and both amplifier and power supply employ etched circuitry throughout. All components are integral to the etched circuit board which is mounted on the chassis and enclosed by a perforated cover. The electrical connector forms an extension of the circuit board and inserts into the shock-mount on which the unit is mounted.

1.4.5 Models 4080A and 4087A Navigation Indicators

The Model 4080A navigation indicator contains two d-c meter movements and an inductive resolver. In VOR operation the meters provide right-left course deviation, and to-from VOR station indication. In localizer operation the same meters provide right-left localizer beam deviation, and warning-flag alarm information. The inductive resolver is electrically a part of the variable-phase channel in the VOR section of the Model 2374 module.

The Model 4087A navigation indicator contains, in addition to the features described above, two d-c meter movements that provide glideslope flag-alarm and glideslope above-below deviation indications.

1.5 EQUIPMENT REQUIRED

The equipment required for a complete LNC-100 System installation is listed in Table 1-3. The following system code is employed: A (LNC-100A), B (LNC-100B), C (LNC-100C), and D (LNC-100D, a dual LNC-100B installation). Varations in models are also indicated in the table.

1.6 MODULE DIMENSIONS AND WEIGHTS

Table 1-4 lists the overall dimensions and weights of Models 5611A, 5640A, 2355, 2374, 4080A, and 4087A modules.

1.7 REFERENCE DATA

1.7.1 Manufacturer's Data

This equipment is manufactured by Motorola Aviation Electronics, Inc., 10916 West Washington Boulevard, Culver City, California, U.S.A. Direct all inquiries concerning maintenance parts to the attention of the Service Parts Department at the above address. Direct all other inquiries to the attention of the Sales Department.

1.7.2 Differences in Models

Variations between component models, and between system combinations, are indicated in Table 1-3.

1.7.3 Frequency Coverage

a. Transmitter, Model 5640A Module

Frequency coverage in the transmitter is available in any one of the following ranges:

(1) 118.00 to 131.95 mc in 0.05-mc steps, 280 channels.
(2) 118.00 to 131.90 mc in 0.1-mc steps, 140 channels.
(3) 118.00 to 126.95 mc in 0.05-mc steps, 180 channels.
(4) 118.00 to 126.90 mc in 0.1-mc steps, 90 channels.

b. Receiver, Model 5611A Module

Frequency coverage in the receiver is available in any one of the following ranges:

(1) 108.00 to 130.90 mc in 0.1-mc steps, 230 channels.
(2) 108.00 to 126.90 mc in 0.1-mc steps, 190 channels.
(3) 118.00 to 130.90 mc in 0.1-mc steps, 130 channels.
(4) 118.00 to 126.90 mc in 0.1-mc steps, 90 channels.

1.8 TECHNICAL CHARACTERISTICS

1.8.1 VHF Transmitter

Type of Operation:	VHF Voice Communication
Frequency Range:	118.00 to 131.95 in 0.05 mc steps maximum. (See Para. 1.7.3a)
Channels:	280 maximum
Number of Crystals:	34 maximum
Output Power:	3 watts
Output Impedance:	50 ohms
Audio Distortion:	3% at 2500 cps; 5% at 400 cps
Demodulated Noise Level:	minus 40 db
Frequency Stability:	plus or minus 0.01% between -40°C to +55°C

1.8.2 VHF Receiver and VOR-Localizer Converters

Sensitivity:	On VOR (omni-range) signals full flag-down indication occurs with less than 7-uv r-f input. Stable course indications are obtainable down to as low as 5-uv r-f input. For communications 10 uv modulated 30% at 1000 cps produce audio output voltage of 0.4 volt at a signal-to-noise ratio of 6 db.
Selectivity Overall:	Total bandwidth of the receiver at 6 db down is greater than 35 kc, and is less than 148 kc at 60 db down.
Automatic Volume Control:	Flat within 5-db total variation from 10-uv to 10,000-uv input.
Audio Fidelity:	Within 6 db, 300 to 3000 cps.
Squelch Circuit:	With the squelch control at maximum the receiver will be quiet for all levels of input signals below 10 uv and will release with a signal of no greater than 80 uv.
Undesired Frequency Rejection:	At least 60 db including adjacent channel and image.
Accuracy of Indicating Circuits:	The indicated bearing will agree within ±1.20 degrees of the mean bearing.
Modulation Frequencies:	A variation in percentage modulation of the carrier by a variable-phase signal from 25% to 35% shall not create an error of more than ±1/2 degree on VOR. When the percentage modulation of the 90-cps and 150-cps localizer signals is increased from 20% to 25% each, the deviation indicator shall not depart from its centered position by more than 5% of standard deflection.
VOR Input Level Variations:	Variation of input signal level to VOR converter of 4 db (from 0.7 to 1.2 volts rms) shall not create an additional error of more than ±1 degree. On localizer operation the deviation indication shall not depart from the center position by more than 10% of the standard deflection under the same conditions.
B-Plus Variations:	Variations of power supply voltage from 280 to 300 vdc shall not create an additional error of more than ±1/2 degree on VOR, or ±3 ua on localizer.

1.8.3 75 MC Marker Beacon Receiver

Sensitivity:	0.8 volt audio output for i-f input of 200 microvolts.
Audio Frequency Response:	Spread in audio output over combined ranges of 380-420 cps, 1235-1365 cps, and 2850-3150 cps does not exceed 9 db.
AVC	Audio output does not vary more than 10 db when input is increased from 2000 to 50,000 microvolts.

1.8.4 Power Supply-Amplifier-Modulator

a. Power Supply:

Input Voltage:	14 or 28 volts dc.
Output Power:	To Transmitter: 288 ± 6% vdc, 95 ma
	To Receiver: 136 ± 6% vdc, 70 ma
	To 2374 Module: 294 ± 6% vdc, 45 ma
	To 5607 Module: 132 + 6% vdc, 20 ma

b. Amplifier-Modulator

Maximum Power Output (Audio)	5 watts into 3.2 ohms with an input signal of 1.0 volt rms.
Maximum Power Output (Modulator)	7 watts into 4100 ohms with an input signal of 0.9 volt rms.
Frequency Response:	The output is linear within 6 db from 350 to 3000 cps.

1.9. TUBE COMPLEMENT CHARTS

All vacuum tubes in Models 5640A, 5611A, 2355, and 2374 modules are listed in the following tables by tube designation, type, and function. Transistors in Model 2355 module are also listed.

TABLE 1-5. VACUUM TUBE COMPLEMENT, MODEL 5640A MODULE

Tube	Type	Function
V-101	12AT7	Sect. A: m-c oscillator
		Sect. B: fractional-mc oscillator
V-102	6BC5	Mixer
V-103	5686	Driver
V-104	5686	Final power amplifier

TABLE 1-6. VACUUM TUBE COMPLEMENT, MODEL 5611A MODULE

Tube	Type	Function
V-201	6BC5	R-F amplifier
V-202	6U8	Sect. A: 1st mixer
		Sect. B: m-c oscillator
V-203	6BC5	Variable i-f amplifier
V-204	6U8	Sect. A: 2nd mixer
		Sect. B: tenth-mc oscillator
V-205	6U8	Sect. A: fixed i-f amplifier
		Sect. B: navigation output amplifier
V-206	6U8	Sect. A: fixed i-f amplifier
		Sect. B: 2nd detector and AVC
V-207	12AT7	Sect. A: audio amplifier
		Sect. B: squelch amplifier

TABLE 1-7. VACUUM TUBE COMPLEMENT, MODEL 2355 MODULE

Tube	Type	Function
V-301	12AT7	Sect. A: audio amplifier
		Sect. B: phase-inverter
V-302	12AB5	Push-pull output amplifier
V-303	12AB5	Push-pull output amplifier
Q-301	2N174	DC-AC conversion
Q-302	2N174	DC-AC conversion

TABLE 1-8. VACUUM TUBE COMPLEMENT, MODEL 2374 MODULE

Tube	Type	Function
V-401	12AU7	Sect. A: VOR composite signal amplifier
		Sect. B: cathode-follower
V-402	6SA8	Sect. A: limiter-amplifier
		Sect. B: diode detector
V-403	12AT7	Sect. A: push-pull output amplifier
		Sect. B: push-pull output amplifier
V-404	6U8	Sect. A: localizer composite signal amplifier
		Sect. B: cathode follower
V-405	12AT7	Sect. A: audio amplifier
		Sect. B: audio amplifier
V-406	12AT7	Sect. A: push-pull output amplifier
		Sect. B: push-pull output amplifier
V-407	6U8	Sect. A: grid leak detector
		Sect. B: r-f amplifier

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SECTION II
GENERAL THEORY OF OPERATION

2.1 GENERAL

This section contains a general description of the operation of the LNC-100 radio communication and navigation system. The system functions are described in relation to block diagrams, Figures 2-1, 2-2, and 2-3, that cover the receiving, transmitting, and power supply facilities of the system respectively. The block diagrams and related texts are constructed on a "signal flow" basis and do not indicate the physical location or packaging of the system components. A detailed circuit description of each of the system components is included in Section III.

2.2 MODEL 5611A VHF RECEIVER (See Figure 2-1)

2.2.1 Introduction

The vhf receiver is designed to receive radio communication and navigation transmissions in the frequency range of 108.00 to 130.90 mc. The receiver utilizes the double-heterodyne conversion process to convert all incoming vhf signals to a fixed intermediate frequency of 3.1 mc. This fixed intermediate-frequency signal is further amplified in a fixed-tuned two-stage amplifier and applied to a second detector for demodulation. The audio output of the second detector has two available paths depending upon the mode of operation. For voice communication the audio signals are fed through a noise-limiter circuit, a squelch circuit, and a single stage of audio amplification. The output of the audio amplifier is coupled to a three-stage audio power amplifier for reproduction in a loudspeaker. When receiving VOR omni-range or ILS-localizer signals the demodulated output of the 2nd detector is coupled through a cathode-follower navigation amplifier to the input circuits of the VOR or localizer converters respectively.

a. R-F and Conversion Stages

The r-f energy received by the communication or navigation antenna is fed to a tuned-grid tuned-plate r-f amplifier. The amplified output of the r-f stage is coupled to the grid of the 1st mixer. A second input to the grid of the 1st mixer is provided by the unit megacycle oscillator. The unit megacycle oscillator utilizes a modified Pierce circuit that is controlled by one of twenty-three crystals selected by the unit megacycle control knob. The megacycle oscillator generates frequencies in the range of 88.00 to 110.00 mc in twenty-three one-megacycle increments.

The tuned-plate circuit of the 1st mixer has a pass-band of 20.00 to 20.90 mc, which represents the r-f carrier and megacycle oscillator difference frequencies. These variable intermediate frequencies are amplified in the first i-f amplifier and coupled to the grid of the 2nd mixer. The output of the tenth-megacycle oscillator is also coupled to the 2nd mixer through a common cathode connection. The tenth-megacycle oscillator utilizes a modified Colpitts circuit that is controlled by one of ten crystals selected by the tenth-megacycle control knob. The tenth-megacycle oscillator generates frequencies in the range of 16.90 to 17.80 mc in ten 0.1-mc increments.

The tuned-plate circuit of the 2nd mixer is fixed-tuned to 3.1 mc, which represents the 1st i-f amplifier and the tenth-megacycle oscillator difference frequencies. This fixed intermediate frequency is applied to the input of a two-stage fixed-tuned i-f amplifier.

b. 2nd Detector and Output Stages

The amplified output of the 3.1-mc, two stage i-f amplifier is applied to the second detector for demodulation of the transmitted intelligence. Automatic volume control bias is also generated in the 2nd detector stage. This avc bias is applied to several of the preceding stages and serves to maintain the gain of the receiver constant for a wide range of input signal levels. For purposes of voice communication the audio output of the second detector is coupled through a noise-limiting circuit and a squelch circuit to a single-stage audio amplifier. The noise-limiter circuit is triggered by transient noise pulses and functions to effectively cut off the audio signal for the duration of the pulses. As the duration of such transients is extremely short, the human ear cannot detect the interruption. The squelch circuit biases the output audio amplifier to cut-off in the absence of any meaningful signal. In this manner "hash" and background noise are eliminated. The final stage of the vhf receiver is a conventional triode audio amplifier. The output of the triode amplifier is coupled to a separate three-stage audio power amplifier for reproduction in a loud-speaker. The three-stage amplifier is located in the Model 2355 module. When receiving VOR or ILS-localizer transmissions the demodulated output of the 2nd detector is coupled through a cathode-follower navigation amplifier to the input circuits of the VOR or localizer converters which are located in the Model 2374 module.

2.3 MODEL 2374 VOR-LOCALIZER-MARKER BEACON RECEIVER (See Figure 2-1)

2.3.1 Introduction

VHF omni-range transmitters are designed to radiate a vhf carrier that is amplitude-modulated with a 9960-cps sub-carrier signal. The sub-carrier in turn is frequency modulated at 30 cps with a deviation ratio of 16. This combined signal radiates at equal intensity in all directions from a central antenna.

Surrounding the central antenna in the form of a square are four additional antennas. These are fed in pairs from a rotating goniometer with the vhf carrier, amplitude modulated at 30 cps, so that the voltage of one antenna is 180 degrees out of phase with that of the next antenna. The net result of this complex radiation system is the generation of a signal in which the relative phase of the two 30-cps modulation components (am and fm) varies proportionally with each point on the VOR transmitter azimuth. At a point lying magnetic north of the transmitter the two 30-cps components are in phase. For successive degrees of rotation in a direction clockwise from magnetic north, the phase of the 30-cps a-m component lags behind that of the 30-cps f-m component by an angle equal to the angle of rotation. The phase of the 30-cps f-m component radiated from the central antenna is maintained constant, and is referred to as the "Reference Phase Signal". The phase of the 30-cps a-m component, radiated from the four equally-spaced antennas, varies with the degree of rotation from magnetic north of the station, and is referred to as the "Variable Phase Signal". From this it follows that in order to determine the particular VOR transmitter radial on which an aircraft is positioned, it is necessary to receive the transmitted vhf signal and determine the phase difference between the 30-cps reference and variable phase signals. Reception of the transmitted vhf signal is accomplished by the vhf receiver described in paragraph 2.2. Determination of the phase difference between the 30-cps reference and variable phase signals is the function of the VOR converter.

a. Input Stage

When tuned to a VOR transmitter the output of the 2nd detector in the vhf receiver consists of a 9960-cps sub-carrier signal that is frequency-modulated at 30 cps with a deviation ratio of 16, i.e. the center frequency of 9960 cps varies on either side by 480 cycles at a rate of 30 times per second. In addition, the zero level of the sub-carrier is varied in amplitude at 30 cps. This composite sub-carrier signal is applied to the composite signal amplifier in the VOR converter. The plate circuit of the composite signal amplifier includes two filters, one of which passes the 9960-cps f-m sub-carrier by but rejects the 30-cps amplitude variations; the other passes the 30-cps amplitude variations but rejects the 9960-cps f-m sub-carrier.

b. Reference Channel

The output of the 9960-cps pass filter consists of a constant-amplitude 9960-cps signal frequency-modulated at 30 cps. This signal is amplified by the reference signal amplifier and applied to the fm slope detector. The fm slope detector consists of a parallel resonant circuit that is tuned to a frequency approximately one-and-a-half greater than that of the 9960-cps sub-carrier. The impedance of the slope-detector circuit varies with the frequency of the applied signal, and as the applied signal is varying in frequency at 30 cps, the 30-cps f-m 9960-cps signal is translated to a 30-cps a-m 9960-cps signal at the slope-detector output. This signal is applied to a conventional a-m diode detector. The demodulated output of the detector consists of a 30-cps amplitude-modulated signal which is further amplified in a push-pull amplifier and applied to the input of the right-left phase-sensitive demodulator circuit.

c. Variable Phase Channel

The output of the 30-cps pass filter consists of a 30-cps amplitude-modulated signal. This signal is coupled by a cathode-follower stage to the rotor winding of the resolver. The resolver consists of a rotor winding magnetically coupled to two stator windings. The angular position of the rotor with respect to the stators is controlled by the O.B.S. (omni-range bearing selector) knob. Mechanically linked to the rotor winding shaft is an azimuth card calibrated in one-degree increments from 0 to 360 degrees. The function of the resolver and its associated tracking network is to change the 30-cps variable channel signal with respect to the 30-cps reference channel signal by known amounts as indicated by the azimuth card.

The 30-cps shifted-phase output of the resolver tracking network is amplified by two stages of audio amplification and applied to the variable-phase input of the phase-sensitive demodulator.

d. Phase Sensitive Demodulator

The phase-sensitive demodulator circuit compares the phase of the 30-cps variable channel signal with that of the 30-cps reference channel signal and produces a d-c output voltage that is proportional in magnitude and polarity to the difference in phase between them. This d-c output voltage actuates a meter movement in the navigation indicator. The meter movement, in turn, controls a right-left pointer.

e. VOR Operation

To select a VOR radial the O.B.S. knob (and resolver rotor) is rotated until the attached azimuth card indicates the bearing of the selected VOR radial against a fixed pointer. If the aircraft is flying on the selected radial, the phase relationship between the reference and variable channel signals at the input to the phase-sensitive demodulator is such that the d-c output centers the right-left pointer in the navigation indicator. If the aircraft is off the VOR radial to the right or the left, the phase relationship between the reference and variable channel signals at the input to the phase-sensitive demodulator is such that the d-c output deflects the right-left pointer to the right or left accordingly. This deflection indicates to the pilot the heading correction necessary to attain the selected radial.

f. TO-FROM Circuit

When a selected VOR radial is attained an ambiguity exists as to whether the observed bearing on the resolver azimuth card is TO the station from the aircraft, or FROM the station to the aircraft. This ambiguity is resolved by shifting the phase of the variable channel signal through an additional 90 degrees, and then applying it together with the reference-phase signal to a second phase-sensitive demodulator circuit. The d-c output of the demodulator operates the TO-FROM d-c meter movement in the

navigation indicator. If, as a result of the 90-degree phase shift the variable and reference channel signals are in phase, the d-c output of the demodulator causes the TO-FROM indicator to read TO. If they are 180 degrees out of phase as a result of the 90-degree phase shift, the TO-FROM indicator is actuated to read FROM.

g. VOR/LOC Relay K-401

The d-c outputs of the right-left and to-from demodulators are applied to the d-c meter movements in the navigation indicator through contacts on automatic VOR/LOC relay K-401, whenever the vhf receiver is tuned to a VOR transmitter frequency. The position of relay K-401 is controlled by the unit and tenth-megacycle control knobs on the vhf receiver.

2.3.2 Localizer Converter

a. Introduction

The function of the localizer component of an ILS (Instrument Landing System) is to provide an aircraft with a visual indication of the right-left horizontal deviation of the aircraft from the center-line of approach to the airport runway.

Localizer transmitters are situated at one end of the airport runway and radiate a composite audio-modulated vhf signal. The transmitters employ specially-designed antenna arrays that form a radiation pattern consisting of two "rabbit ear" lobes. The null, or portion of the radiation pattern where the field strength of the two lobes is equal, lies on a line parallel to the centerline of the runway.

The composite modulation signal consists of a 90-cps and a 150-cps component. The radiation pattern is such that, when the aircraft is flying parallel to the center line of the runway, the fields strengths of the two components are equal. In the lobe to the right of the centerline the field strength of the 150-cps component increases, while that of the 90-cps component decreases, the difference in field strength between the two components increasing with distance from the centerline of the runway. In the left lobe the situation is reversed so that the 90-cps component increases in field strength while that of the 150-cps component decreases, with increasing distance from the centerline of the runway. From this it follows that in order to determine the right-left deviation of the aircraft from the runway centerline, it is necessary to receive the localizer vhf transmission, demodulate and separate the 90- and 150-cps components, and then compare their relative amplitudes. Reception of the vhf transmission is accomplished by the vhf receiver. Demodulation and comparison of the two modulation components is accomplished by the localizer converter.

b. Composite Signal Amplifier

When tuned to a localizer transmitter the output of the 2nd detector in the vhf receiver consists of a composite 90- 150 cps audio signal. This signal is coupled through the navigation amplifier to the composite signal amplifier in the localizer converter. The amplified output of the composite signal amplifier is applied across two parallel resonant filters, tuned respectively to 90 and 150 cps. The voltage outputs across the individual filters are proportional in magnitude to the relative amplitudes of the 90- and 150-cps components of the composite input signal.

c. R-L Demodulator Circuits

The output of each filter is applied to a half-wave diode rectifier. The d-c output voltage of the two rectifiers are connected in series opposition. The resultant output voltage of the two rectifiers energizes a d-c meter movement in the navigation indicator. When the 90- and 150-cps components of the composite signal are equal in amplitude the resultant d-c potential across the d-c meter is zero and the right-left meter pointer remains centered. Deviation of the aircraft to the right or left of the localizer beam unbalances the amplitude of the 90- and 150- cps components and produces a resultant d-c voltage that causes the right-left pointer to deflect accordingly. The deflection of the pointer indicates to the pilot the heading correction necessary to re-attain the beam center.

The d-c output currents of the two rectifiers are connected in a series-aiding circuit to operate a flag-alarm d-c meter movement in the navigation indicator. Failure of either or both of the modulation components or their associated circuitry causes the warning flag to appear.

VOR/LOC relay K-401 is controlled by the unit and tenth-megacycle control knobs on the vhf receiver. When the vhf receiver is tuned to a localizer channel relay K-401 becomes energized. This completes the circuits between the d-c outputs of the localizer converter and the d-c meter movements in the navigation indicator.

2.3.3 75 MC Marker Beacon Receiver

a. Introduction

Marker beacon transmitters are used to provide an aircraft with an aural and/or visual indication of the aircraft along the approach path to the runway. They consist of low-power vhf-transmitter exciting-antenna systems that produce fan-shaped beams so orientated that the broad dimension of the fan is at right angles to the localizer or approach path. The marker transmitters are three in number and are spaced at fixed known intervals along the approach path to the runway. Each of the three transmitters is identified by means of distinctive tone modulations of 3000, 1300, and 400 cps. The function of the marker beacon receiver is to receive and demodulate the marker beacon transmission and provide the pilot with an aural and/or visual identification of the particular beam over which the aircraft is passing.

b. Aural Operation

The 75-mc marker beacon receiver consists of a conventional three-stage t-r-f receiver that is fixed-tuned to 75 mc. Audio-modulated vhf marker transmissions are received by the horizontally-polarized marker beacon antenna and applied to the grid of the tuned-grid tuned-plate r-f amplifier. The amplified

output of the r-f amplifier is applied to the grid-leak detector for demodulation. The d-c component of the demodulated r-f signal is applied to the grid of the input stage for automatic volume control. The final stage of the receiver is a cathode-follower. The low-impedance output of the cathode-follower is coupled by a shielded cable to the input of the three-stage autio power amplifier located in the Model 2355 module.

c. Visual Operation

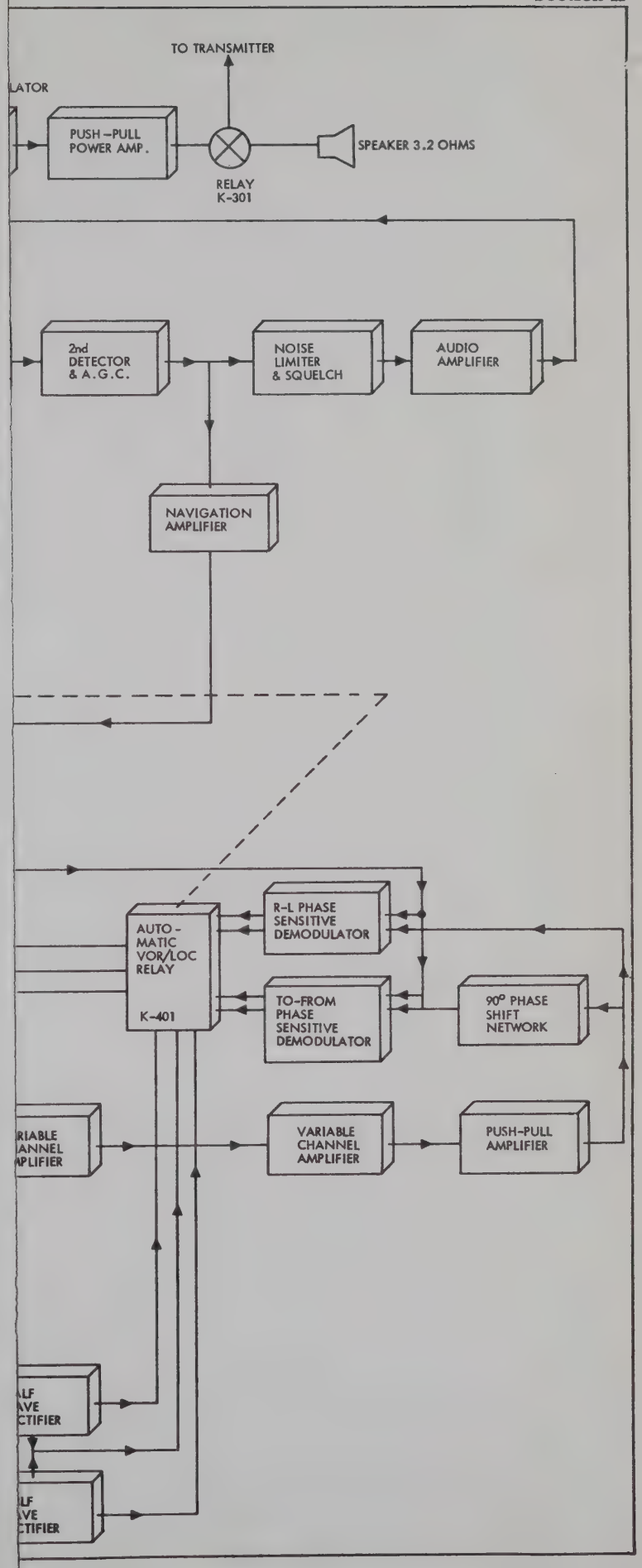
A two-stage transistorized lamp amplifier is available as optional equipment. The amplifier operates an indicator lamp to provide visual as well as aural indication of passage of the aircraft over a marker beam. The lamp amplifier is fed from the output of the grid-leak detector and thus will operate regardless of the position of the receiver sensitivity control, which is located in the output circuit of the cathode-follower stage.

2.4 AUDIO POWER AMPLIFIER

The audio power amplifier consists of a conventional three-stage amplifier. Audio input signals from the vhf or marker-beacon receivers are coupled through a single-stage of triode amplification to a second triode that functions as a phase inverter. The phase-inverter stage provides two 180-degree out-of-phase inputs to the final push-pull power amplifier. The amplified output of the push-pull amplifier is transformer-coupled to a 3.2-ohm speaker for voice reproduction. The audio power amplifier is located in the Model 2355 module and serves a dual purpose by operating as a modulator for the vhf transmitter in the "TRANSMIT" mode of operation.

2.5 TRANSMIT-RECEIVE RELAY K-301

Relay K-301 is energized by the TRANSMIT-RECEIVE button switch on the microphone handset. Figure 2-1 shows in block form the resulting circuit configuration when relay K-301 is in the RECEIVE position. A detailed description of the switching function of K-301 is included in Section III.


TO TRANSMITTER
LATOR
PUSH–PULL POWER AMP.
RELAY K-301
SPEAKER 3.2 OHMS
2nd DETECTOR & A.G.C.
NOISE LIMITER & SQUELCH
AUDIO AMPLIFIER
NAVIGATION AMPLIFIER
AUTO-MATIC VOR/LOC RELAY
K-401
R-L PHASE SENSITIVE DEMODULATOR
TO-FROM PHASE SENSITIVE DEMODULATOR
90° PHASE SHIFT NETWORK
VARIABLE CHANNEL AMPLIFIER
PUSH-PULL AMPLIFIER

output of the r-f amplifier is applied to the grid-leak detector for demodulation. The d-c component of the demodulated r-f signal is applied to the grid of the input stage for automatic volume control. The final stage of the receiver is a cathode-follower. The low-impedance output of the cathode-follower is coupled by a shielded cable to the input of the three-stage autio power amplifier located in the Model 2355 module.

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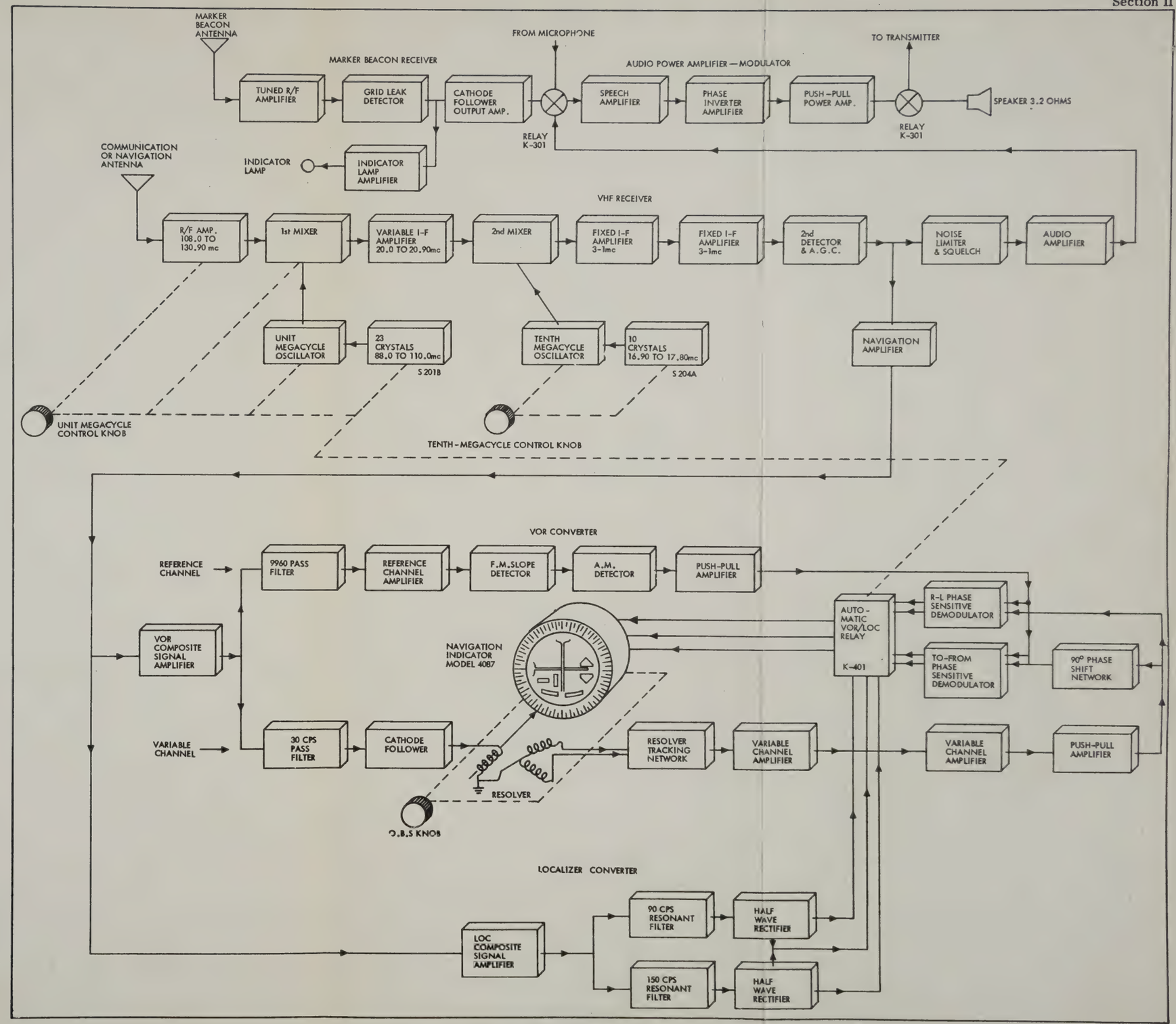


Figure 2-1. System Block Diagram: Receiving Functions

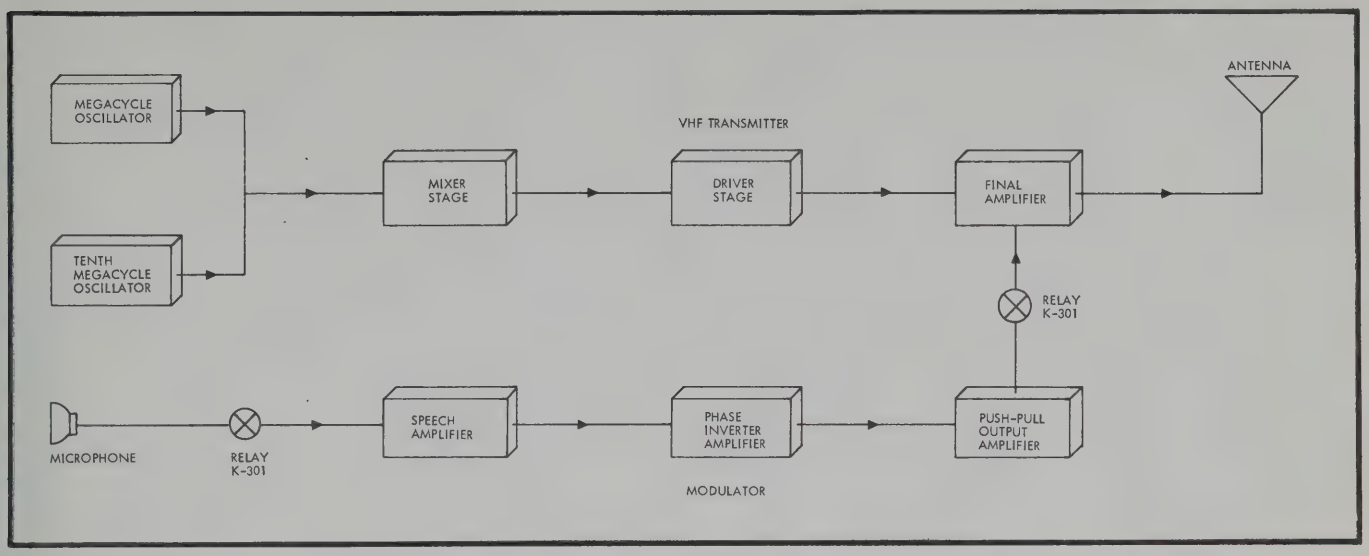


Figure 2-2. Block Diagram: Transmitter and Modulator

2.6 MODEL 5640A VHF TRANSMITTER (See Figure 2-2).

2.6.1 Introduction

The vhf transmitter is designed to provide vhf voice communication over the frequency range of 118.00 to 131.90 mc. The transmitter employs a "crystal saving" circuit arrangement that utilizes 24 crystals to cover this frequency range in 140 discrete 0.1-mc increments. All tuning is accomplished by the unit megacycle and tenth-megacycle control knobs mounted concentrically on the transmitter front panel. Final stage plate modulation is provided by a three-stage dual-purpose modulator-amplifier located separately in the Model 2355 module.

2.6.2 Transmitter Stages

The transmitter employs a unit megacycle oscillator and a tenth-megacycle oscillator, the outputs of which are combined in a mixer stage. The unit megacycle oscillator generates frequencies in the range of 82.00 to 95.00 mc in 14 one-megacycle steps. The tenth-megacycle oscillator generates frequencies in the range of 36.00 to 36.90 mc in ten 0.1-mc steps.

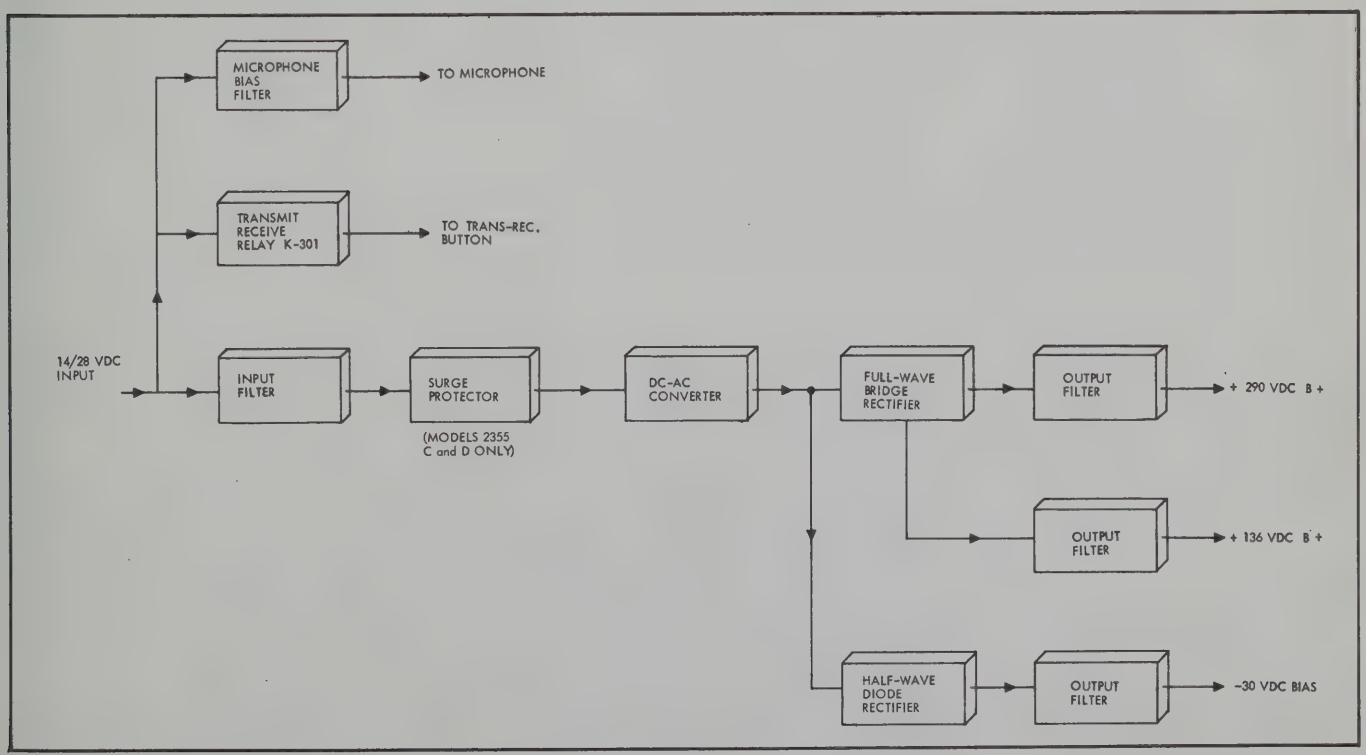


Figure 2-3. Block Diagram: Power Supply

The outputs of both oscillators are fed to the input of the mixer stage which is tuned to the sum of the two input frequencies. Output of the mixer is applied to a tuned driver-amplifier that provides driving power for the final output power amplifier.

2.7 MODEL 2355 POWER SUPPLY-AMPLIFIER-MODULATOR (See Figure 2-3)

The power supply circuits of the Model 2355 module provide d-c power for the entire LNC-100 System. The primary 14- or 28-vdc is applied through suitable filters (and a surge protector circuit in Models 2355 C and D only) to the input of the dc-ac converter. The surge protector protects the transistorized dc-ac converter from transient line surges due to regulation of the aircraft power supply. The primary d-c is also applied to the coil of transmit-receive relay K-301. In addition, the primary dc, after suitable filtering, is used for microphone bias voltage. The dc-ac converter consists of two transistors that operate as a self-switching circuit in conjunction with a saturable-reactor transformer, to transform the low-voltage d-c input to a high-voltage a-c output. The a-c output of the converter is applied to a full-wave bridge rectifier. The full rectified d-c output (250 vdc) of the bridge rectifier provides B+ voltage for the VOR and localizer converters, the VHF transmitter, and the audio amplifier-modulator. Half of the d-c output (125 vdc) of the bridge rectifier provides B+ voltage for the vhf and marker beacon receivers.

Half of the a-c output of the dc-ac converter is rectified by a half-wave rectifier circuit to provide negative 30-vdc bias for the push-pull output stage of the amplifier-modulator. A detailed circuit description of the power supply is included in Section III.

SECTION III

DETAILED CIRCUIT THEORY

3.1 MODEL 5640A VHF TRANSMITTER

3.1.1 General

The Model 5640A module contains two crystal-controlled oscillators, a mixer stage, a driver stage, and a final output amplifier stage. Plate modulation is provided by a three-stage speech amplifier-modulator located in the Model 2355 module.

3.1.2 Unit Megacycle Oscillator V-101A (See Figure 3-1)

Unit megacycle oscillator V-101A is a crystal-controlled oscillator that generates frequencies in the range of 82.00 to 95.00 mc in 14 one-megacycle steps. Crystal selection is made by megacycle selector switch S-102. The tuned-plate circuit consists of the inter-electrode plate-grid capacitance of triode

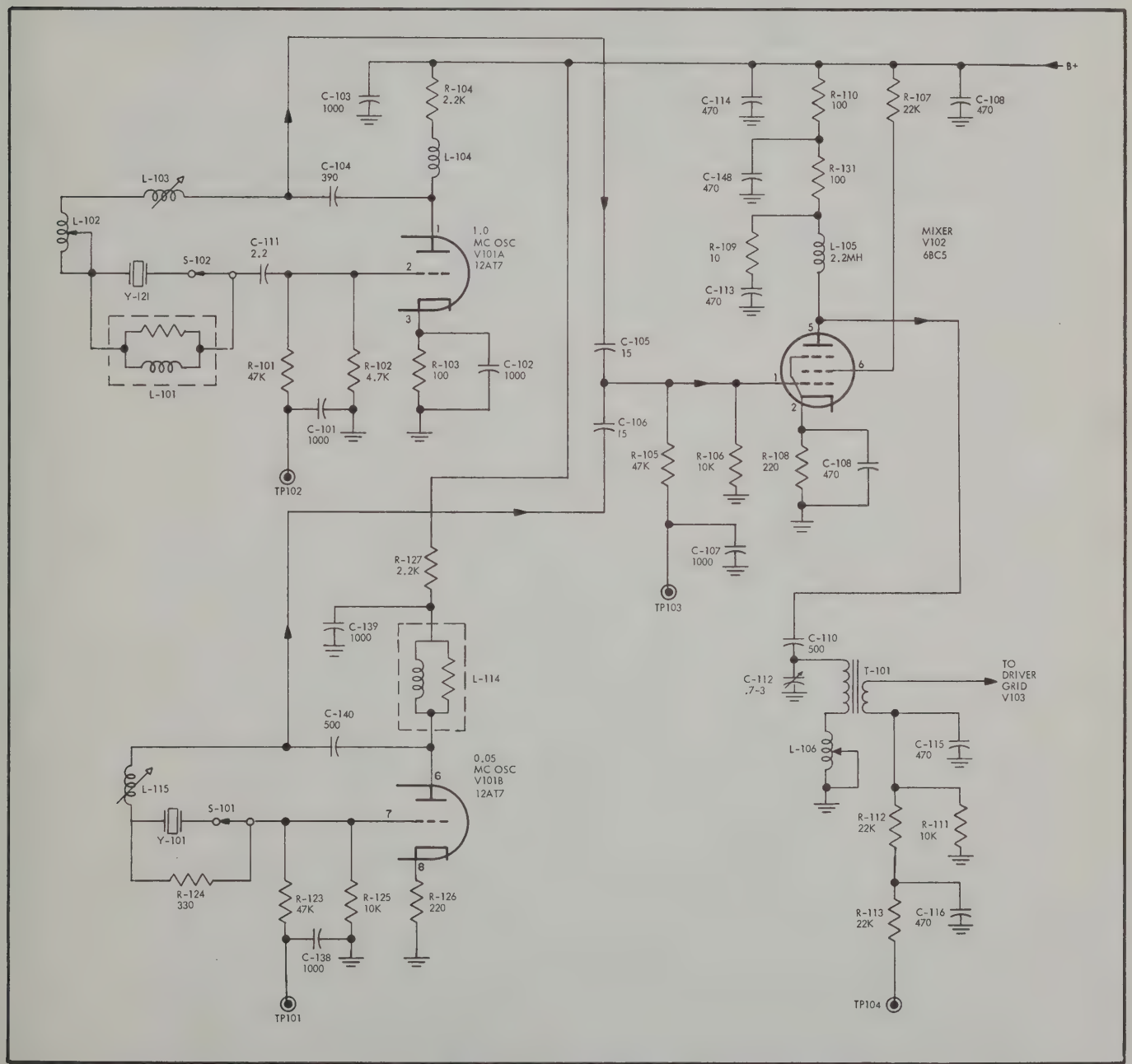


Figure 3-1. Transmitter Frequency Generating Circuits, Simplified Schematic Diagram

V-101A in parallel with tapped-inductance L-102 and variable inductance L-103. The selected megacycle crystal is placed in series with the tuned-plate circuit between the plate and grid of V-101A, and controls the frequency of oscillation through its effect on the magnitude and phase of the feedback voltage through the tube. The crystals are ground to operate in the fifth overtone series mode. R-F choke L-101 is in parallel with the operating crystal and provides sufficient damping to prevent the crystal from operating at any frequency other than its series mode. Resistor R-104, capacitor C-103, and r-f choke L-104 form an r-f decoupling network that isolates the r-f signal from the B+ supply. Resistor R-102 provides a ground return for the grid of V-101A, and resistor R-103 and capacitor C-102 provide conventional cathode bias and r-f by-pass. During the positive peaks of r-f voltage grid current flows and capacitor C-101 acquires a negative charge through resistor R-101 that is proportional to the amplitude of the oscillations in the circuit. This voltage is brought out to test point TP-102 for measurement and alignment purposes. Capacitor C-104 blocks the B+ voltage from the tuned-plate circuit and crystals. The output of unit megacycle oscillator V-101A is coupled to the grid of mixer V-102 through capacitor C-105 and resistor R-106.

3.1.3 Fractional-Megacycle Oscillator V-101B

Fractional-megacycle oscillator V-101B is a crystal-controlled modified Pierce Oscillator that differs from unit megacycle oscillator V-101A only in the range of frequencies generated. Oscillator V-101B generates frequencies in the range of 36.00 to 36.95 mc in twenty 0.05-mc steps. The tuned-plate circuit consists of the inter-electrode plate-grid capacitance of triode V-101B in parallel with slug-toned inductance L-115, and covers a one-megacycle band of frequencies. The specific frequency within the one-megacycle band is determined by the selected crystal. The 20 crystals employed to cover the range are operated in the third overtone series mode. Other components in the circuit have similar functions to their counterparts in the unit megacycle oscillator. The negative d-c voltage developed across capacitor C-138 is proportional to the amplitude of the r-f oscillations. This voltage is brought out to test point TP-101 for measurement and alignment purposes. The output of fractional-megacycle oscillator V-101B is coupled to the grid of mixer V-102 through capacitor C-106 and resistor R-106.

3.1.4 1st Mixer V-102

The r-f signals from oscillators V-101A and V-101B are combined at the grid of mixer V-102, which is biased to operate on the non-linear portion of its plate-voltage, plate-current characteristic. The plate circuit of V-102 is tuned to the sum of the two oscillator frequencies in 14 one-megacycle steps by tapped-inductance L-106 and the inter-electrode grid-plate capacitance of mixer V-102. Variable-capacitor C-112 serves as a trimmer for alignment

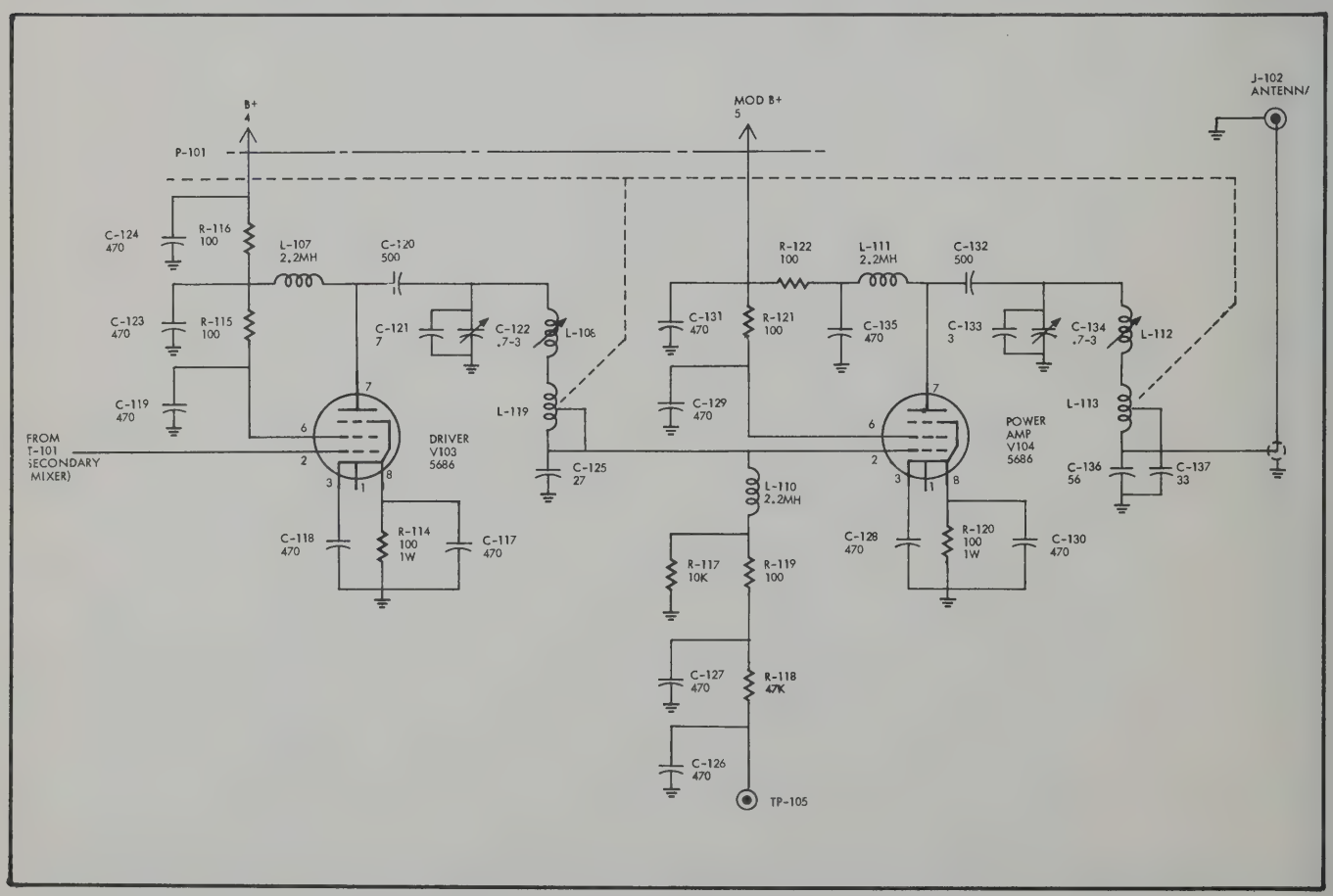


Figure 3-2. Transmitter Driver and Power Output Stages, Simplified Schematic Diagram

TABLE 3-1. VHF TRANSMITTER FREQUENCY DATA

FREQ. CONTROL SETTING	MC OSC	MC XTAL	FRACTIONAL MC OSC	FRACTIONAL MC XTAL
118.00	82.00	Y-121	36.00	Y-101
118.05	82.00	Y-121	36.05	Y-102
118.10	82.00	Y-121	36.10	Y-103
118.15	82.00	Y-121	36.15	Y-104
118.20	82.00	Y-121	36.20	Y-105
118.25	82.00	Y-121	36.25	Y-106
118.30	82.00	Y-121	36.30	Y-107
118.35	82.00	Y-121	36.35	Y-108
118.40	82.00	Y-121	36.40	Y-109
118.45	82.00	Y-121	36.45	Y-110
118.50	82.00	Y-121	36.50	Y-111
118.55	82.00	Y-121	36.55	Y-112
118.60	82.00	Y-121	36.60	Y-113
118.65	82.00	Y-121	36.65	Y-114
118.70	82.00	Y-121	36.70	Y-115
118.75	82.00	Y-121	36.75	Y-116
118.80	82.00	Y-121	36.80	Y-117
118.85	82.00	Y-121	36.85	Y-118
118.90	82.00	Y-121	36.90	Y-119
118.95	82.00	Y-121	36.95	Y-120
119.00	83.00	Y-122	36.00	Y-101
119.95	83.00	Y-122	36.95	Y-120
131.00	95.00	Y-134	36.00	Y-101
131.95	95.00	Y-134	36.95	Y-120

at the high end of the band. The negative d-c voltage on the grid of V-102 is brought out to test point TP-103 for measurement and alignment purposes. Resistors R-109, R-110, and R-131, and capacitors C-113, C-114, and C-148, together with r-f choke L-105, de-couple the r-f signal from the B+ supply. The r-f output of mixer V-102 is inductively coupled to the grid of driver V-103 by r-f transformer T-101. Table 3-1 provides a tabulation of the frequencies existing at each stage of the circuit during the mixing process.

3.1.5 Driver V-103 (See Figure 3-2)

The output voltage across the secondary of T-101 is applied to the grid of driver V-103. Capacitor C-115 provides an r-f ground for the secondary of T-101 and permits the grid return resistor, R-111, to be connected at the "cold" end of the coil. The negative d-c voltage at the grid of V-103 is brought out to test point TP-104 for measurement and alignment purposes. The plate circuit of driver V-103 is tuned in 14 one-megacycle steps by tapped-inductance

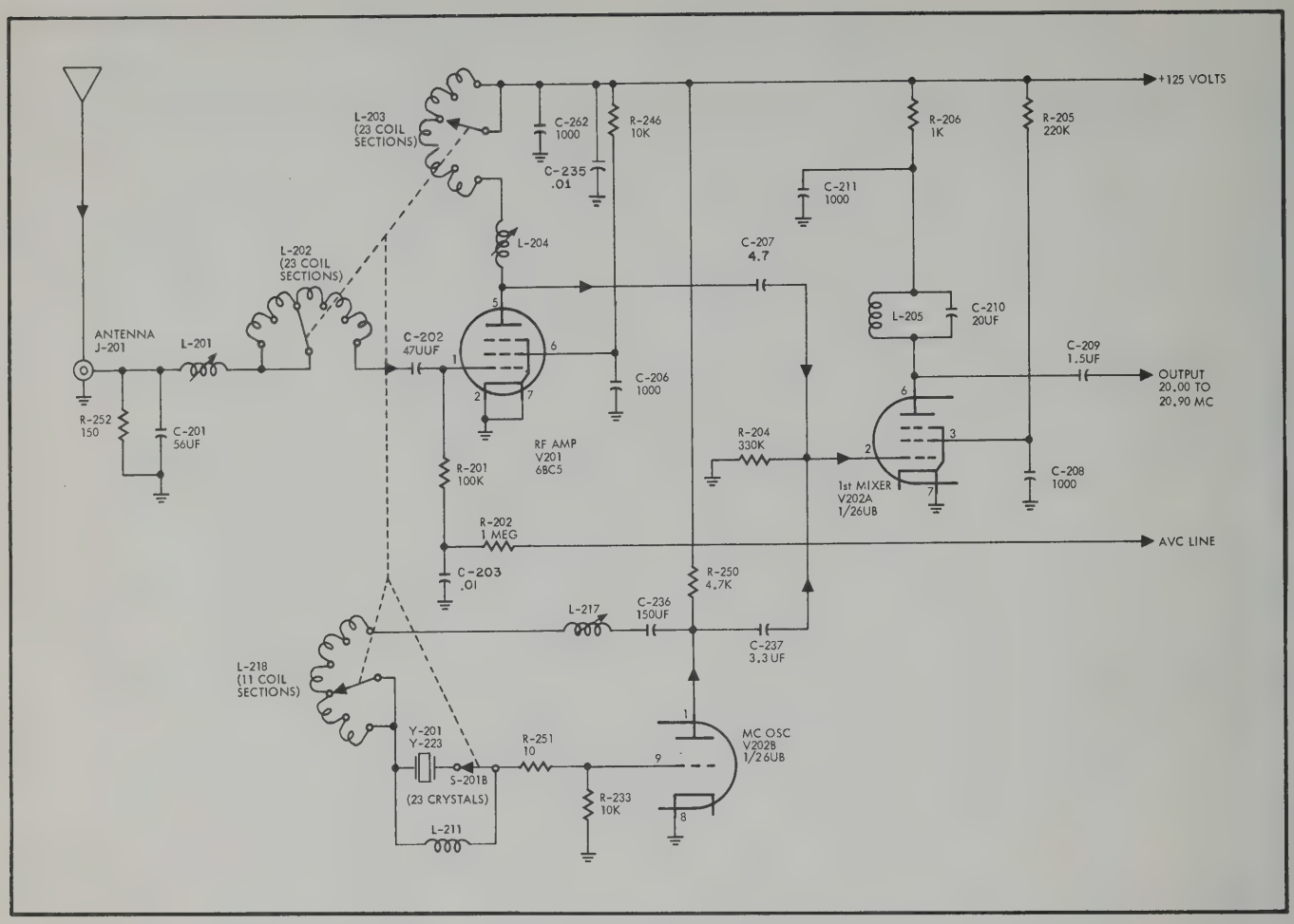


Figure 3-3. Receiver 1st Conversion Stages, Simplified Schematic Diagram

L-119 and the inter-electrode grid-plate capacitance of the tube. Slug-tuned inductance L-108 and variable-capacitor C-122 serve for alignment purposes at the low and high end of the band respectively. Resistors R-115, and R-116, and capacitors C-119 and C-124, together with r-f choke L-107 and capacitor C-123, de-couple the r-f signal from the B+ supply. Capacitor C-120 blocks the B+ voltage from the grid of the following stage.

3.1.6 Final Amplifier V-104

The output of driver V-103 is coupled to the grid of final amplifier V-104 across impedance-matching capacitor C-125. The grid of V-104 is returned to ground through r-f choke L-110 and resistor R-117. The negative d-c voltage at the grid of V-104 is brought out of TP-105 for measurement and alignment purposes. Speech-modulated B+ is supplied to the plate of V-104 through r-f choke L-111 and de-coupling network R-122 and C-135. The plate circuit of V-104 is tuned by tapped-inductance L-113 and the inter-electrode capacitance of the tube. Slug-tuned inductance L-112 and variable capacitor C-134 are used for alignment at the high and low ends of the tuning range. The modulated r-f output of V-104 is coupled to the antenna across impedance-matching capacitors C-136 and C-137.

3.1.7 Transmitter Switching Circuits

All tuning is performed by two rotary-ganged switches that are controlled by two knobs mounted concentrically on the front panel of the receiver. The megacycle selector switch, S-102, consists of five ganged wafers that perform the following functions:

a. Select the desired megacycle crystal for the megacycle oscillator.

b. Select the corresponding inductance tap for the tuned-plate circuits of megacycle oscillator V-101A, mixer V-102, driver V-103, and final amplifier V-104.

The fractional-megacycle selector switch, S-101, selects the desired crystal for fractional-megacycle oscillator V-101B only.

3.2 MODEL 5611A VHF RECEIVER

3.2.1 General

The Model 5611A module employs a double-heterodyne process to convert the frequency of the incoming r-f signal to a fixed intermediate-frequency

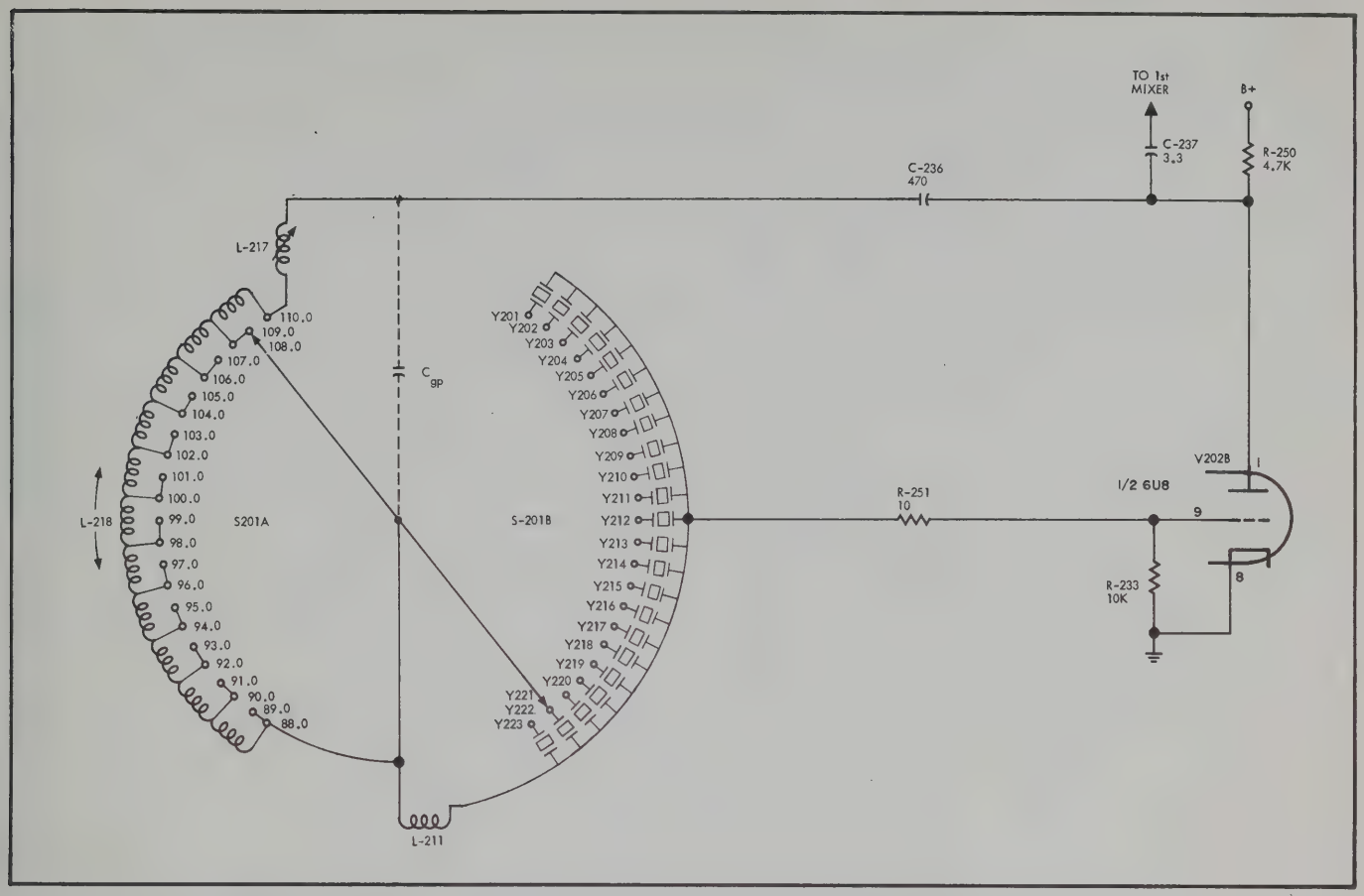


Figure 3-4. Receiver Unit Megacycle Oscillator, Simplified Schematic Diagram

of 3.1 mc. A two-stage tuned-transformer coupled amplifier amplifies the 3.1 mc signal. Output of the two-stage i-f amplifier is applied to the first detector for demodulation. The audio output of the detector follows two paths. One path is through a noise limiter and a squelch circuit to the input of a triode audio amplifier. The other is taken directly to the input of a cathode-follower amplifier. The output of the cathode-follower provides the signal to the Model 2374 module.

3.2.2 R-F Amplifier V-201 (See Figure 3-3)

R-F amplifier V-201 is a conventional pentode amplifier having a tuned plate and grid. The grid is tuned by the combination of slug-tuned inductance L-201, tapped-inductance L-202, and the interelectrode grid-to-cathode capacitance of V-201. Signals from the antenna are coupled to the tuned-grid-circuit through capacitor C-201 and resistor R-252 which function to match the impedance of the antenna (50 ohms) to the input impedance of V-201 (approximately 1500 ohms). Capacitor C-202 is in series with Cgc and thereby minimizes the effects of any change in grid-to-cathode capacitance resulting from tube replacement. The grid of V-201 is returned to the avc circuit through resistors R-201 and R-202, which together with capacitor C-203 function as an avc filter. Screen-dropping resistor R-246 and capacitor C-206 provide r-f de-coupling of the screen grid of V-201, while capacitors C-235 and C-262 function as B+ line by-pass capacitors for lower-frequency components. Tapped-inductance L-202 is tuned through the frequency range of 108.00 to 131.00 mc in 24 one-megacycle increments by megacycle selector switch S-201. Slug-tuned inductance L-201, in series with L-202, functions as an alignment control.

3.2.3 1st Mixer V-202A

The tuned-plate circuit of V-201 consists of tapped-inductance L-203 and slug-tuned inductance L-204 in parallel with the plate-to-cathode capacitance of the tube. Signals developed across this circuit are applied to the grid of 1st mixer V-202A through coupling capacitor C-207 and grid-return resistor R-204. Tapped inductance L-203 is also tuned in 24 one-megacycle increments by megacycle selector switch S-201, while L-204 functions as an alignment control. 1st mixer V-202A heterodynes the incoming signal from V-201 with an injected voltage from unit megacycle oscillator V-202B to produce a variable intermediate frequency at the plate of V-202A in the range of 20.00 to 20.95 mc. Screen-dropping resistor R-205 and capacitor C-208 provide r-f de-coupling for the screen grid of V-202A while resistor R-206 and capacitor C-211 serve a similar function for the plate.

3.2.4 Unit Megacycle Oscillator V-202B (See Figure 3-4)

Unit megacycle oscillator V-202B is a crystal-controlled Pierce Oscillator that generates frequencies

in the range of 88.00 to 110.00 mc in 23 one-megacycle increments. Crystal selection is made by megacycle selector switch S-201. The tuned-plate circuit consists of the inter-electrode plate-grid capacitance of V-202B in parallel with fixed inductance L-217 and tapped-inductance L-218. The selected megacycle crystal is placed in series with the tuned plate circuit between the plate and grid of V-202B and controls the frequency of oscillation through its effect on the magnitude and phase of the feedback voltage through the tube. The crystals are ground to operate in the fifth overtone series mode. R-F choke L-211 is in parallel with the operating crystal and provides sufficient damping to prevent the crystal from operating at any frequency other than its series mode. Resistor R-251 also increases the stability of the circuit by acting as a "damper" to spurious oscillations. Blocking capacitor C-236 isolates the B+ from the grid of the tube and resistor R-233 completes the grid circuit to ground. Figure 3-4 illustrates how the plate circuit of V-202B is tuned through 88.00 to 110.00 mc by the megacycle selector switch. The total plate inductance (L-217 and L-218) is divided into twelve sections by wafer S-201A of the megacycle selector switch. Each section covers a two-mc band of frequencies. The specific megacycle frequency within the band is determined by one of two crystals that are matched to each section of the plate inductance by wafer S-201B of the megacycle selector switch. The output of the unit megacycle oscillator is coupled to the grid input of 1st mixer V-202A through coupling capacitor C-237.

3.2.5 Variable I-F Amplifier V-203 (See Figure 3-5)

The tuned-plate circuit (L-205 and C-210) of 1st mixer V-202A is "top capacity" coupled to the tuned-grid input circuit (L-206 and C-212) of V-203 through coupling capacitor C-209. The output of the 1st mixer consists of a variable intermediate frequency in the range of 20.00 to 20.95 mc. Capacitor C-213 prevents the avc line from grounding through L-206. The grid of V-203 is returned to the avc line through resistors R-208 and R-247. C-214 is an avc filter capacitor. Conventional cathode bias and r-f by-pass are provided by R-209 and C-215. Plate voltage is applied to V-203 through the r-f de-coupling circuit consisting of R-211 and C-218. The screen voltage is dropped through the voltage divider consisting of resistors R-210 and R-203, and by-passed for r-f capacitor C-216.

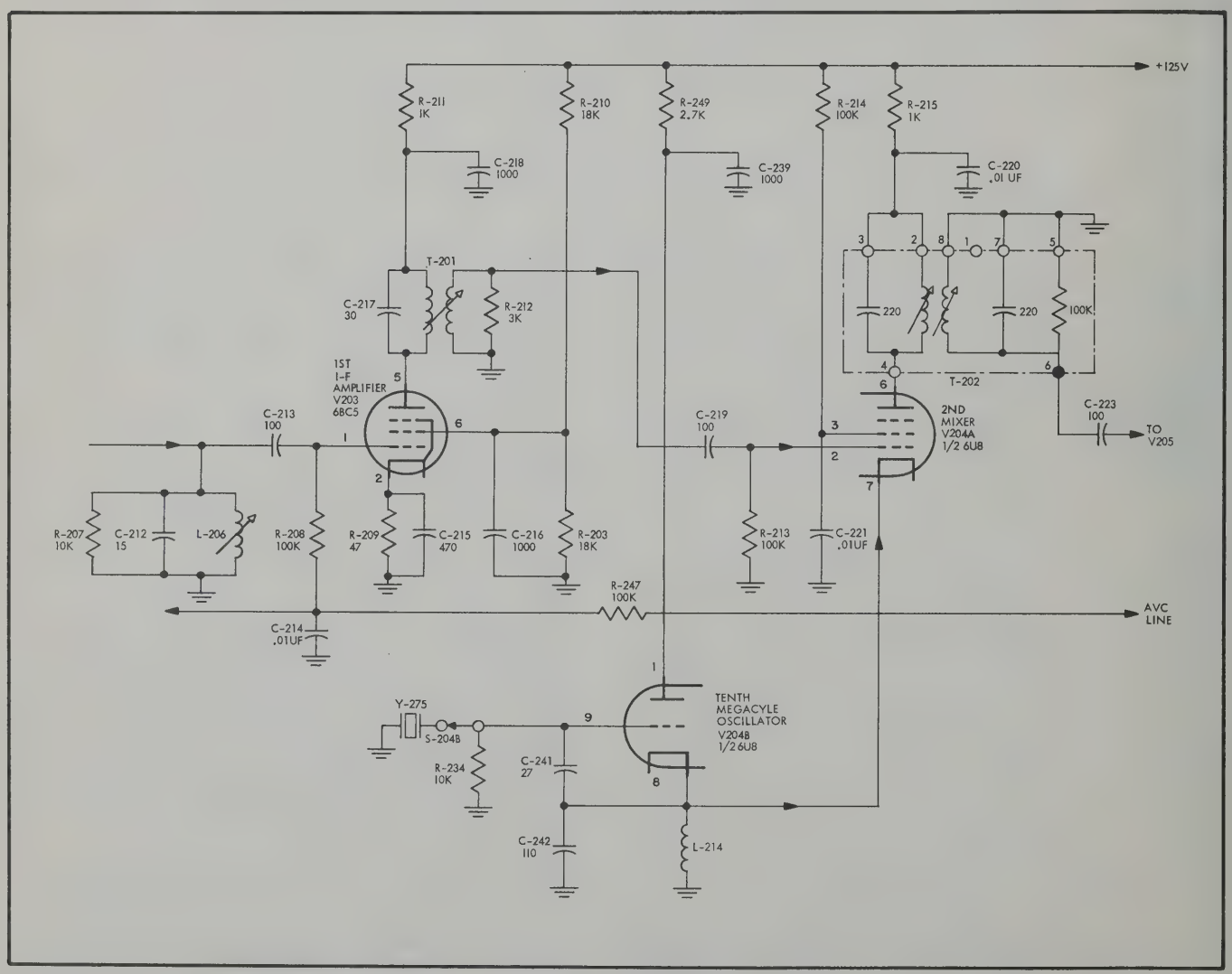


Figure 3-5. Receiver 2nd Conversion Stages, Simplified Schematic Diagram

TABLE 3-2. VHF RECEIVER FREQUENCY DATA

R-F AMP	MC OSC	MC XTAL	VAR. I-F AMP	TENTH-MC OSC	TENTH-MC XTAL	FIXED I-F
108.00	88.00	Y-201	20.00	16.90	Y-225	3.1
108.05	88.00	Y-201	20.05	16.95	Y-226	3.1
108.10	88.00	Y-201	20.10	17.00	Y-227	3.1
108.15	88.00	Y-201	20.15	17.05	Y-228	3.1
108.20	88.00	Y-201	20.20	17.10	Y-229	3.1
108.25	88.00	Y-201	20.25	17.15	Y-230	3.1
108.30	88.00	Y-201	20.30	17.20	Y-231	3.1
108.35	88.00	Y-201	20.35	17.25	Y-232	3.1
108.40	88.00	Y-201	20.40	17.30	Y-233	3.1
108.45	88.00	Y-201	20.45	17.35	Y-234	3.1
108.50	88.00	Y-201	20.50	17.40	Y-235	3.1
108.55	88.00	Y-201	20.55	17.45	Y-236	3.1
108.60	88.00	Y-201	20.60	17.50	Y-237	3.1
108.65	88.00	Y-201	20.65	17.55	Y-238	3.1
108.70	88.00	Y-201	20.70	17.60	Y-239	3.1
108.75	88.00	Y-201	20.75	17.65	Y-240	3.1
108.80	88.00	Y-201	20.80	17.70	Y-241	3.1
108.85	88.00	Y-201	20.85	17.75	Y-242	3.1
108.90	88.00	Y-201	20.90	17.80	Y-243	3.1
108.95	88.00	Y-201	20.95	17.85	Y-244	3.1
109.00	89.00	Y-202	20.00	16.90	Y-225	3.1
109.95	89.00	Y-202	20.95	17.85	Y-244	3.1
130.00	110.00	Y-223	20.00	16.90	Y-225	3.1
130.95	110.00	Y-223	20.95	17.85	Y-244	3.1

3.2.6 2nd Mixer V-204A

The output of variable i-f amplifier V-203 is coupled to the grid of 2nd mixer V-204A by tuned-transformer T-201 which passes a one-megacycle band of frequencies in the range of 20.00 to 20.95 mc. The output of tenth-megacycle oscillator V-204B is also coupled to 2nd mixer V-204A through the common cathode connection of the two tubes. The plate impedance of 2nd mixer V-204A consists of the primary circuit of fixed tuned i-f transformer T-202, which is tuned to the difference-frequency between the two signal inputs. The frequencies generated by the tenth-megacycle oscillator are such that the fixed i-f frequency of the receiver is 3.1 mc. Table 3-2 is a tabulation of the frequencies existing at each stage of the circuit throughout the double-conversion heterodyne process for the 108.00- through 108.95-mc channels. The existing frequencies are shown in abbreviated form for the 109.00- through 130.95-mc channels.

3.2.7 Tenth-Megacycle Oscillator V-204B

Tenth-megacycle oscillator V-204B is a modified Pierce Oscillator that generates frequencies in

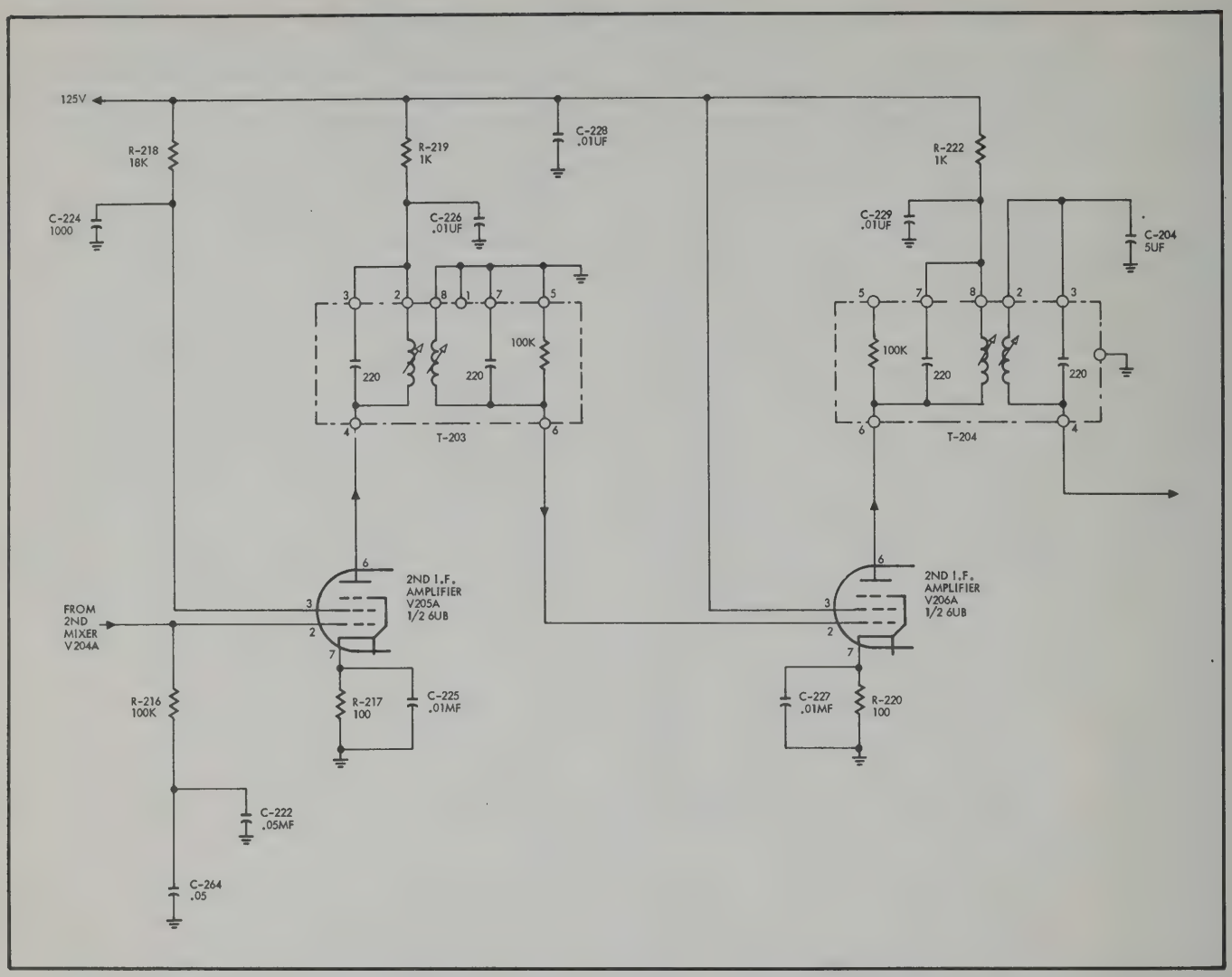


Figure 3-6. Receiver Fixed 3.1 MC I-F Amplifier, Simplified Schematic Diagram

the range of 36.00 to 36.95 mc in twenty 0.05-mc steps. The circuit is fundamentally a Colpitts oscillator in which the tank inductance has been replaced with a crystal. Capacitors C-241 and C-242 form a voltage-divider across the crystal. The ratio of these capacitors determines the amplitude of oscillations in the circuit. Inductance L-214 functions as a common cathode load to couple the output of the low-injection oscillator to the cathode of second mixer V-204A. The specific frequency within the one-megacycle band is determined by one of 20 crystals selected by tenth-megacycle selector switch S-204A.

3.2.8 Fixed 3.1-MC I-F Amplifier V-205A and V-206A (See Figure 3-6)

The fixed i-f amplifier consists of two stages of conventional amplification (V-205 and V-206) coupled by three double-tuned transformers (T-202, T-203, and T-204). The stages differ only in the fact that the screen of V-205 is connected to B+ through dropping resistor R-218, and the grid of V-205 is returned to the avc line through resistor R-216. C-222 is an avc filter capacitor.

3.2.9 Audio Detector and Noise Limiter V-206 (See Figure 3-8)

The output voltage across the secondary of fixed i-f transformer T-204 is applied to the cathode-grid portion of triode V-206B, which in conjunction with load resistors R-226 and R-225, functions as a diode detector. The simplified schematic, figure 3-8A, illustrates operation of the circuit. The audio and d-c components of the demodulated signal are developed across load resistors R-225 and R-226. Capacitor C-233 functions as an r-f by-pass for the r-f component. Due to the cathode-input connection of the equivalent diode, point A acquires a negative d-c potential with respect to ground. This potential charges capacitor C-234 through resistor R-227. The cathode of crystal diode CR-201 is connected to C-234 through resistor R-228 and thus assumes the same potential as C-234, which in turn is the potential of point A. The plate of diode CR-201 is connected to the junction of R-225 and R-226, point B in Figure 3-8A, which is at a lower negative potential than point A due to the voltage drop on R-226. Thus the plate of diode CR-201 is at lower negative potential

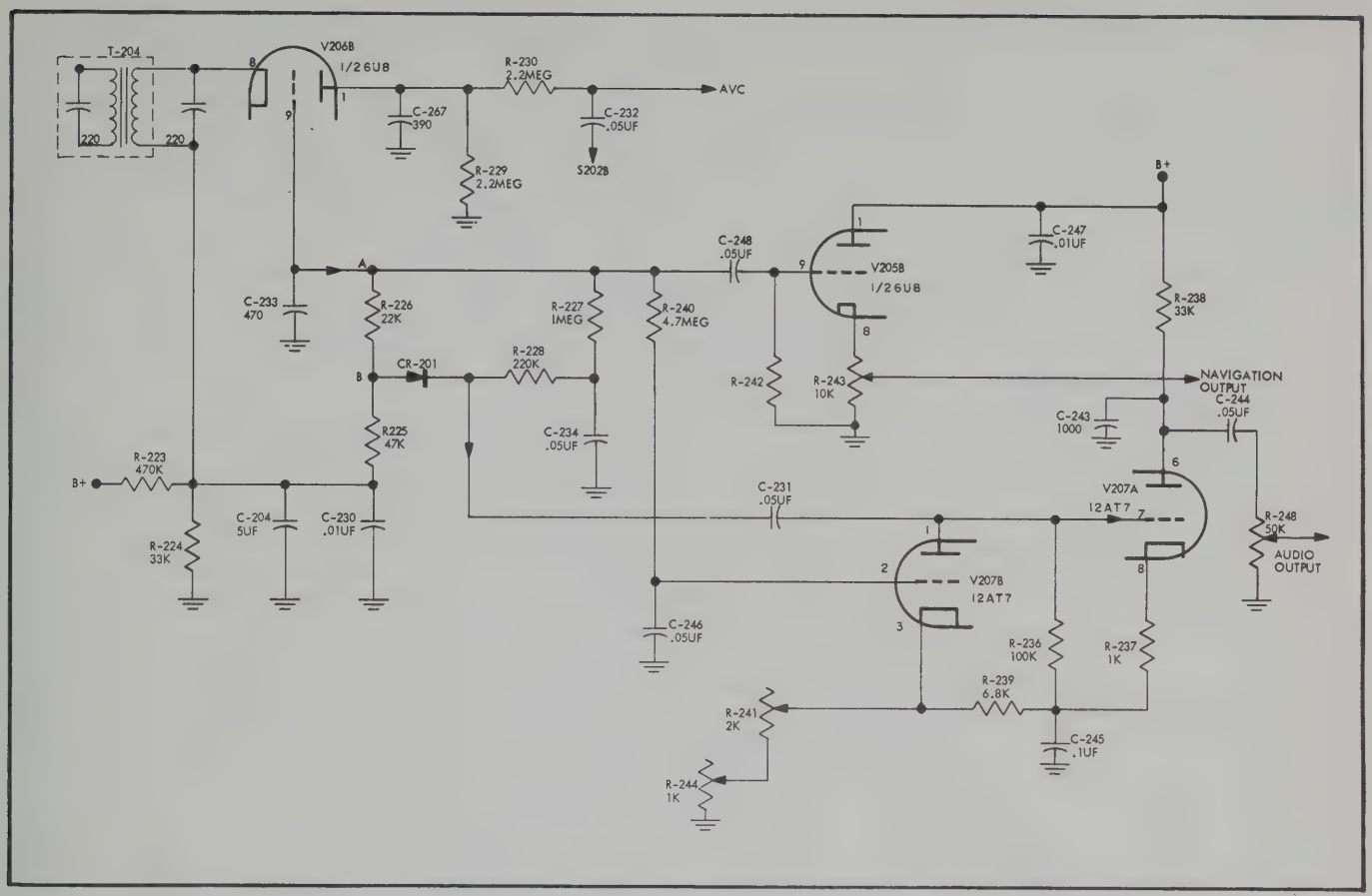


Figure 3-7. Receiver 2nd Detector, Squelch, Audio and Navigation Amplifiers, Simplified Schematic Diagram

than the cathode, which in effect makes the plate positive to the cathode, i.e., the diode is forward-biased to the conducting portion of its characteristic (see Figure 3-8B). Under these conditions the audio component of the demodulated signal at point B passes through the diode to the grid of audio amplifier V-207A. Upon receipt of a high-level noise pulse, however, point A is driven increasingly negative. The plate of diode CR-201, which is connected to point A through R-226, is also driven increasingly negative. Capacitor C-234 cannot immediately assume the potential of point A, however, due to the time-constant of C-234 and R-227. Thus the cathode of CR-201, which is connected to C-234, is held at its original potential until C-234 charges to the voltage level of point A. During this interval CR-201 is reverse-biased to the non-conducting portion of its characteristic and the audio signal is cut-off from the audio amplifier. When the noise pulse terminates, the potential at point A resumes its normal value as does the plate of CR-201, so that the diode is again forward-biased and in a conducting condition for audio signals.

3.2.10 Squelch Amplifier V207B (See Figure 3-7)

In the presence of an audio signal the grid of squelch amplifier V-207B assumes the negative d-c potential of point A, to which it is connected through resistor R-240. Capacitor C-246 serves as a by-pass for the audio component of the demodulated signal. Under these conditions V-207B is cut-off and the audio signals across load resistors R-226 and R-225 (point B) are coupled to audio amplifier V-207A through capacitor C-231. In the absence of an input signal to the receiver, the negative d-c potential at point A disappears. This causes V-207B to conduct. Resistor R-236 functions as both the plate load resistor of V-207B and the grid return of V-207A, and when V-207B conducts, a voltage drop is developed across it. This negative voltage drop across R-236 drives the grid of V-207A to cut-off, which serves to eliminate hash and background noise in the absence of any meaningful signal. The point at which V-207B conducts is adjustable by means of cathode potentiometers R-241 and R-244, which enable variation of the fixed bias (and hence the conducting point) of the tube. One potentiometer is mounted on the front panel of the receiver to permit adjustment of the squelch level by the operator. The other is located within the receiver for calibration purposes.

3.2.11 Delayed AVC Circuit V-206B (See Figure 3-9)

The plate and cathode of triode V-206B function as a separate diode detector for the automatic volume-control circuit. The output of fixed i-f amplifier T-204 is applied across the "cathode plate" diode and produces a demodulated signal in load resistor R-229. The d-c component of the demodulated signal provides a variable negative bias to the grids of controlled stages V-201, V-203, and V-205. The audio frequency component of the demodulated signal

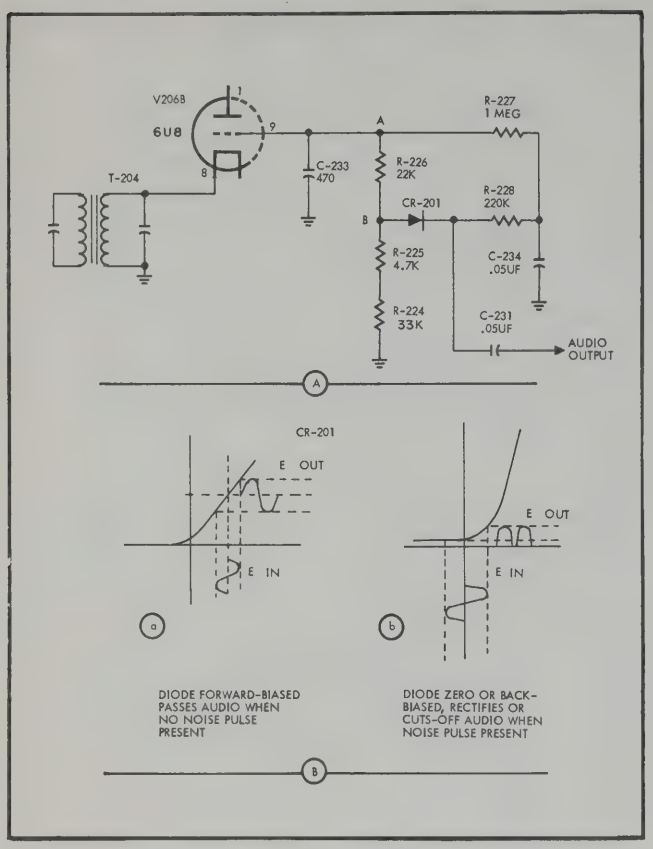


Figure 3-8. Receiver 2nd Detector and Noise Limiter, Simplified Schematic Diagram

is by-passed to ground through capacitor C-232. The magnitude of the d-c component (negative bias) is proportional to the level of the incoming carrier signal and serves to maintain the gain of the receiver constant over a wide range of input signals. In order to prevent the introduction of avc in the presence of weak signals, a positive bias is applied to the cathode of V-206B from the voltage divider consisting of R-223 and R-224. This biases the cathode approximately +7.5 volts with respect to the plate, and thus delays introduction of the avc bias until the peak amplitude of the incoming signal has exceeded this value.

3.2.12 Audio Amplifier V-207A (See Figure 3-7)

Audio amplifier V-207A provides a single stage of conventional audio amplification. The audio-frequency component of the demodulated input signal is coupled to the grid of V-207A through capacitor C-231. The amplified plate output of V-207A is developed across audio-gain potentiometer R-248 through coupling capacitor C-244. Capacitor C-243 provides a low-impedance path to ground for any residual r-f components of the demodulated signal. The wiper of gain control R-248 is connected to pin 4 of connector P-203.

3.2.13 Navigation Output Amplifier V-205B (See Figure 3-7)

When tuned to navigation channels (VOR/LOC) the full audio output at the plate of the detector (grid of V-206B) is coupled to the grid of navigation amplifier V-205B through capacitor C-248 and grid-return resistor R-242. V-205B functions as a cathode follower to isolate the input stage of the navigation converter from the output of the audio detector. Potentiometer R-243 in the cathode of V-205B serves as a gain control for the audio navigation output signal. As the audio input to V-205B is taken from the plate of the detector (point A, Figure 3-8), navigation signals are not subject to noise limiter or squelch amplifier. action.

3.2.14 Receiver Switching Circuits (See Receiver Schematic, Appendix I)

a. General

The Model 5611A module is tuned by two ganged switches, the shafts of which are controlled by two knobs mounted concentrically on the front panel of the receiver. The large outer knob controls the positions of the megacycle-selector switch wafers, which select the crystals and other tuning elements required to tune the receiver through the range of 108.00 to 130.00 mc in 23 one-megacycle steps. The small inner knob controls the position of the tenth-megacycle selector switch, which selects the crystals required to tune the receiver in 50-kc increments between each of the one-megacycle steps selected by the megacycle-selector switch, and to a maximum of 130.95 mc.

b. Megacycle Selector Switch

Four ganged wafers control the megacycle tuning of the receiver. Wafer S-201B selects the desired crystal for the unit megacycle oscillator. Wafer S-201A selects the corresponding tap on oscillator plate inductance L-218. Two additional ganged wafers form tapped-inductances L-202 and L-203, which tune the grid and plate circuits of r-f amplifier V-201 in 23 one-megacycle steps. Wafers S-202A and S-202B are also controlled by the megacycle selector switch and function as part of the auxiliary control system described in paragraph 3.2.14d below.

c. Tenth-Megacycle Selector Switch

Wafer S-204A of the tenth-megacycle selector switch selects one of twenty crystals required to tune the tenth-megacycle oscillator from 16.9 through 17.85 mc in twenty 0.05-mc increments. Three additional wafers, S-203A, S-203B, and S-205A, are also controlled by the tenth-megacycle selector switch, and function as part of the auxiliary control system described in paragraph 3.2.14d below.

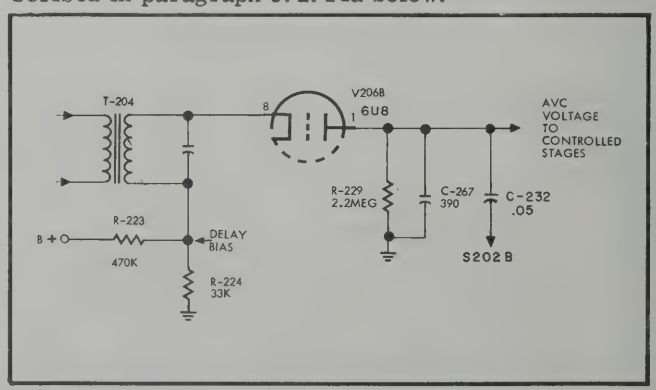


Figure 3-9. Receiver Delayed A.V.C. Circuit, Schematic Diagram

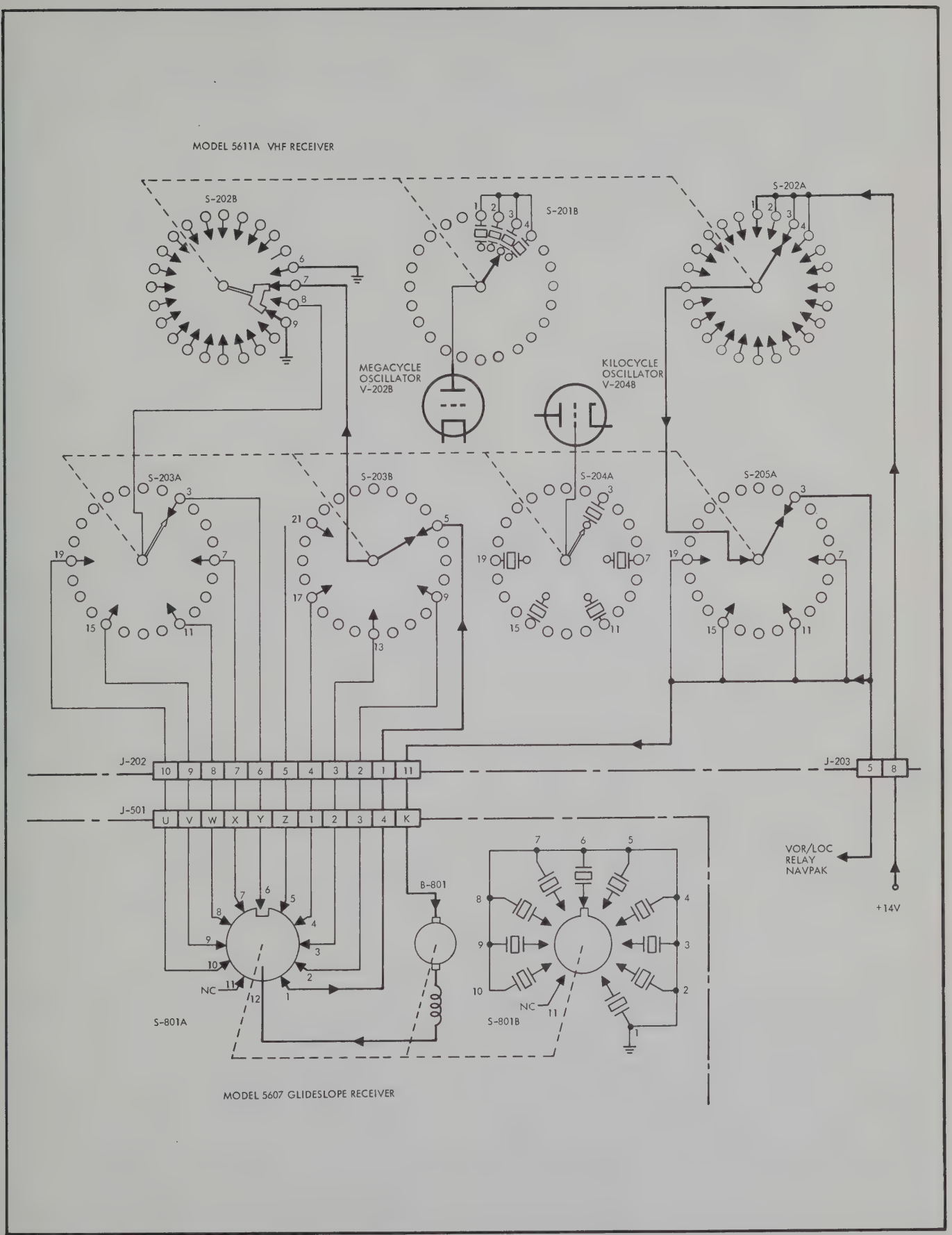


Figure 3-10. Receiver Auxiliary Equipment Control Switching, Simplified Schematic Diagram

TABLE 3-3. AUXILIARY EQUIPMENT SWITCHING, LOCALIZER-GLIDESLOPE CHANNELS

VOR FREQUENCY MC	LOCALIZER FREQUENCY MC	GLIDESLOPE FREQUENCY MC	ARINC GLIDESLOPE CHANNEL NO.	ICAO SEQUENCE NO.	GROUNDED PINS	
					GLIDESLOPE RCVR. CONNECT. J-501	VHF RCVR. CONNECT. J-202
108.00						
	108.10	334.7	1	11	4	1
108.20						
	108.30	334.1	2	12	3	2
108.40						
	108.50	329.9	3	13	2	3
108.60						
	108.70	330.5	4	14	1	4
108.80						
	108.90	329.3	5	15	2	5
109.00						
	109.10	331.4	6	7	Y	6
109.20						
	109.30	332.0	7	6	X	7
109.40						
	109.50	332.6	8	3	W	8
109.60						
	109.70	333.2	9	5	V	9
109.80						
	109.90	333.8	10	2	U	10
110.00						
	110.10	334.4	1	4	4	1
110.20						
	110.30	335.0	2	1	3	2
110.40						
	110.50	329.6	3	10	2	3
110.60						
	110.70	330.2	4	9	1	4
110.80						
	110.90	330.8	5	8	Z	5

TABLE 3-3. AUXILIARY EQUIPMENT SWITCHING, LOCALIZER-GLIDESLOPE CHANNELS (Cont)

VOR FREQUENCY MC	LOCALIZER FREQUENCY MC	GLIDESLOPE FREQUENCY	ARINC GLIDESLOPE CHANNEL NO.	ICAO SEQUENCE NO.	GROUNDED PINS	
					GLIDESLOPE RCVR. CONNECT.	VHF RCVR. CONNECT. J-202
111.00						
	111.10	331.7	6	16	Y	6
111.20						
	111.30	332.3	7	17	X	7
111.40						
	111.50	332.9	8	18	W	8
111.60						
	111.70	333.5	9	19	V	9
111.80						
	111.90	331.1	10	20	U	10

d. Auxiliary Equipment Control Switching Circuit (See Figure 3-10)

The Model 5611A module is designed to operate in conjunction with any standard ARINC glideslope receiver for the reception of ILS (Instrument Landing System) transmissions, and incorporates the necessary switching circuits required for synchronous tuning of the two receivers. Table 3.3 pairs the twenty assigned localizer channels with the corresponding glideslope channels. The auxiliary switching system automatically tunes the associated glideslope receiver to the correct channel, as the Model 5611A receiver tunes to the paired localizer channel. A second function of the auxiliary switching system is to switch the navigating indicator instrument from the VOR to the localizer circuits of the Model 2374 module, when the Model 5611A module is tuned to a localizer frequency.

Figure 3-10 is a simplified schematic that illustrates the operation of the auxiliary equipment control switching system when the Model 5611A VHF Receiver is operated in conjunction with the Motorola Model 5607D, E, or F Glideslope Receiver.

NOTE

The Model 5607 D, E, or F Glideslope Receiver is designed to operate on glideslope channels 1 through 10 only. The auxiliary equipment control switching system of the Model 5611A module has, therefore, been modified slightly so that the tuning mechanism of the glideslope receiver is actuated only when the Model 5611A module is tuned to the ten localizer frequencies that correspond to glideslope channels 1 through 10. These modifications are indicated in Figure 3-10. The specific localizer frequencies corresponding to glideslope channels 1 through 10 are listed in Table 3-3 and commence with 109.10 mc, which corresponds to glideslope channel 6 (331.4 mc).

The switching circuit operates by applying primary d-c power (14 or 28 vdc) to the glideslope receiver tuning mechanism whenever the Model 5611A module is tuned to a localizer frequency. The tuning mechanism then operates to tune the glideslope receiver to the corresponding glideslope channel.

Primary d-c power enters the Model 5611A module at pin 8 of connector J-203, and is connected to pin 5 of J-203 (and hence pin 11 of J-202) through megacycle switch wafer S-202A and tenth-megacycle switch wafer S-205A, when the receiver is tuned to a localizer frequency. Wafer S-202A forms a closed circuit for the dc when the megacycle-selector switch is set to positions 1, 2, 3, and 4, corresponding to frequencies of 108.00, 109.00, 110.00, and 111.00 mc only. Wafer S-205A forms a closed circuit for the dc when the tenth-megacycle selector switch is set to positions 3, 7, 11, 15, and 19, corresponding to fractional megacycle frequencies of 0.1, 0.3, 0.5, 0.7, and 0.9 mc only. Thus, wafers S-202A and S-205A, in combination, provide 20 discrete paths between the vdc source and channel motor B-801 in the glideslope receiver. Each of these paths corresponds to a localizer frequency as selected by the megacycle and tenth-megacycle selector switches.

If the glideslope receiver is tuned to some other than the required channel, the d-c motor (B-801) circuit is returned to ground through homing wafer S-801A and either wafers S-203A and S-202B, or wafers S-203B and S-202B, depending upon the actual localizer channel to which the Model 5611A module is tuned. The resultant rotation of motor B-801 rotates homing wafer S-801A and crystal selector wafer S-801B until the d-c motor circuit is broken by the cut-out section of S-801A coming in line with the energized channel. At this point the glideslope receiver is tuned to the desired channel.

To illustrate the foregoing, Figure 3-10 assumes that the Model 5611A module has just been switched

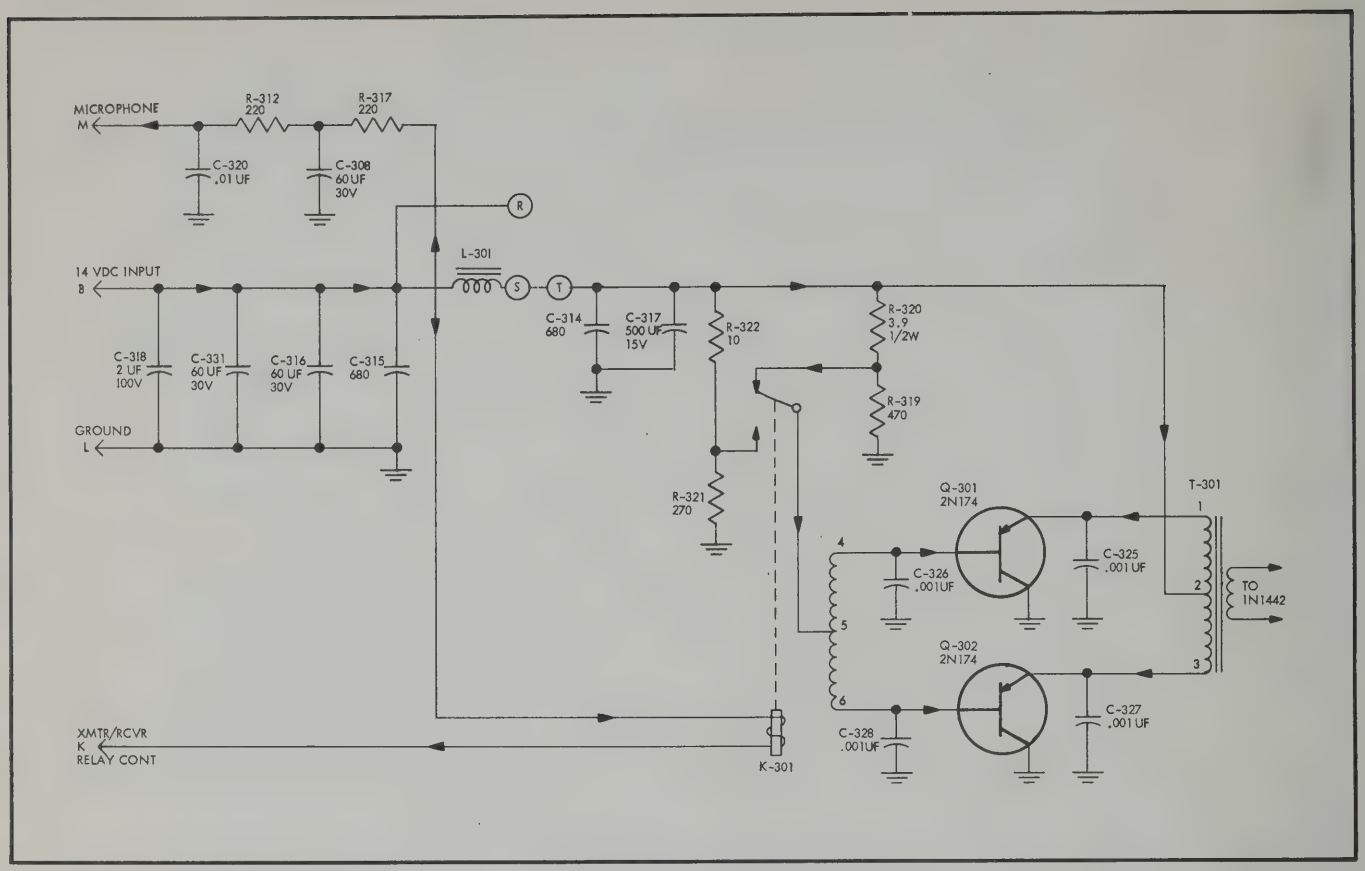


Figure 3-11. Power Supply Input and DC-AC Converter, Simplified Schematic Diagram

from 109.10 mc (corresponding to glideslope channel 6) to 110.10 mc (corresponding to glideslope channel 1). The switching circuit must now operate to re-tune the glideslope receiver from channel 6 to channel 1. The heavy line shows the completed d-c circuit across channel motor B-801. The motor, which is mechanically linked to homing wafer S-801A and crystal selector wafer S-801B, proceeds to rotate until the cut-out on homing wafer S-801A reaches terminal 1 and breaks the circuit. The glideslope receiver is now tuned to channel 1.

The VOR/LOC relay in the Model 2374 module is connected to pin 5 of connector J-203, and therefore becomes energized whenever the Model 5611A module is tuned to a localizer frequency. The VOR/LOC relay, when energized, switches the VOR/LOC navigation instrument from the VOR to the localizer circuits of the converter.

A secondary function of megacycle wafer S-202B (see receiver schematic) is to ground avc filter capacitors C-232 and C-250 during the reception of navigation frequencies (108.00 to 117.00 mc). This improves the filtering of the avc line for the 30-cps component of the VOR modulation signal.

3.3 MODEL 2355 POWER SUPPLY-AMPLIFIER-MODULATOR

3.3.1 General

The Model 2355 module contains the primary power supply for the entire LNC-100 System, together with a dual-purpose amplifier that functions as a modulator during transmission and as an audio amplifier during reception. The three functions are described separately in the succeeding paragraphs.

3.3.2 Power Supply

a. Input Circuits (See Figure 3-11)

The d-c input voltage (14 or 28 vdc) is applied to tap 2 of saturable-reactor transformer T-301 through an r-f filter consisting of capacitors C-314 and C-315 and r-f choke L-301. Taps 1 and 3 of T-301 are connected to the emitters of junction transistors Q-301 and Q-302. The d-c voltage is also applied across a voltage-divider consisting of either resistors R-319 and R-320, or resistors R-321 and R-322, depending upon the position of transmit-receive relay K-301. The reduced output of the selected voltage-divider is applied to tap 5 of T-301, and hence to the bases of Q-301 and Q-302 through taps 4 and 6 respectively. Transistors Q-301 and Q-302 in conjunction with transformer T-301 form a dc-ac voltage converter that converts the low-voltage primary dc into a high-voltage ac.

b. Surge Protector (See Figure 3-12)

The C and D versions of the Model 2355 module include a transistorized surge protector in series with the primary d-c supply circuit. This unit is designed to protect transistors Q-301 and Q-302 in

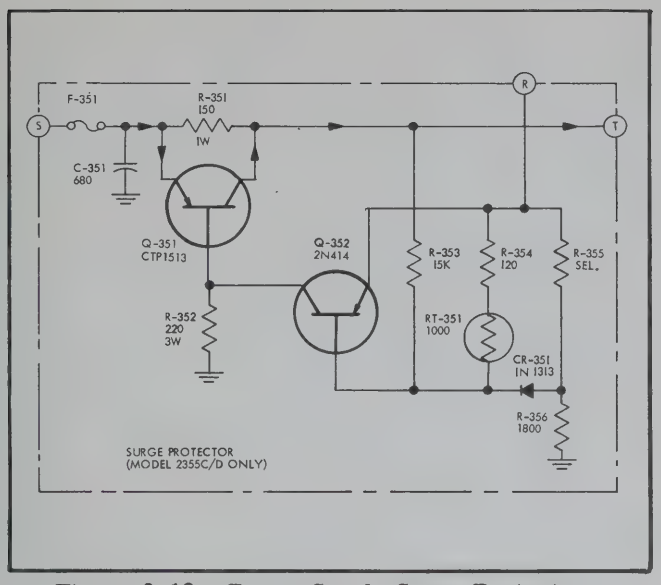


Figure 3-12. Power Supply Surge Protector, Simplified Schematic Diagram

the dc-ac converter circuit against voltage transients on the primary d-c lines caused by regulation of the aircraft supply. The unit consists of transistors Q-351 and Q-352 and their associated circuitry. Under normal conditions Q-351 is forward-biased to conduction and Q-352 is reverse-biased toward cut-off. As a result, the supply current passes through L-301 and the emitter-collector circuit of Q-351 directly to the dc-ac converter.

When an instantaneous voltage rise appears on the line the increased voltage drop across voltage-divider R-355 and R-356 causes zener diode CR-351 to be forward-biased into heavy conduction. This action drives the base of Q-352 negative with respect to its emitter and as a result Q-352 goes from cut-off to conduction. The increased voltage drop across R-352 caused by the collector current of Q-352 drives the base of Q-351 positive with respect to its emitter and hence into cut-off. As a result, dropping resistor R-351, which is normally shunted by the emitter-collector circuit of Q-351, is placed in series with the d-c primary supply line. This causes the output voltage of the protector circuit to drop for the duration of the transient.

c. DC-AC Converter

Figure 3-13 is a simplified schematic of the dc-ac converter. Operation of the circuit is based on the fact that if the base voltage of a p-n-p junction transistor is carried through a sufficient range with respect to its emitter, the unit may be made to operate from cut-off to full conduction in a similar fashion to a relay or switch. In the circuit configuration shown, the transistors form an alternating self-switching device analogous to a vacuum-tube multivibrator, in which one tube conducts for a pre-set time while the other is cut-off, and then reverses itself so that the former tube is cut-off while the latter conducts.

A characteristic of the p-n-p junction transistor is that it will conduct if the base is more negative than either the emitter or collector, and will block, or cut-off, if the base is more positive than both emitter and collector. The full d-c supply voltage is applied to the emitters of both transistors through tap 2 of transformer primary winding B, C. Voltage divider R-319 and R-320, connected across the d-c supply, applies a slightly lower voltage to the bases of both transistors through tap 5 of transformer primary winding A, D. This results in the two bases being approximately 0.6 volt negative (less positive) to their respective emitters, which is the required condition for conduction. Due to the lack of perfect symmetry between the two sections of the circuit, however, one transistor commences to conduct before the other. To facilitate the explanation it is assumed that Q-301 begins to conduct first. When conduction through Q-301 commences the d-c supply is effectively applied across primary winding B of T-301. As conduction increases a rising magnetic field is created which induces a back emf in all four sections of the transformer primary of the polarities shown in Figure 3-13. This induced emf tends to support the initial action by driving the base of Q-301 to a less positive potential and the base of Q-302 to a greater positive potential. This action continues until the increasing current carries the core of T-301 into magnetic saturation ($+B_S$ in Figure 3-14). When the core saturates, the magnetic field becomes stationary, and the induced emf in the primary windings falls rapidly to zero. As the induced emf in winding B falls to zero, the current through the winding (emitter-collector current of Q-301) rises to its maximum value, being limited only by the ohmic resistance of the winding. The increased voltage-drop across winding B due to the high-saturation current makes the emitter of Q-301 negative with respect to its base, i.e. the base becomes positive with respect to the emitter, and Q-301 is cut-off. This causes the current in the primary windings of T-301 to fall to zero. As the current decreases, the stationary magnetic field around the windings commences to collapse. Due to the hysteresis of the core, however, the field does not fall to zero, but to the point of positive remanence ($+B_r$ in Figure 3-14). This slight decrease in magnetic

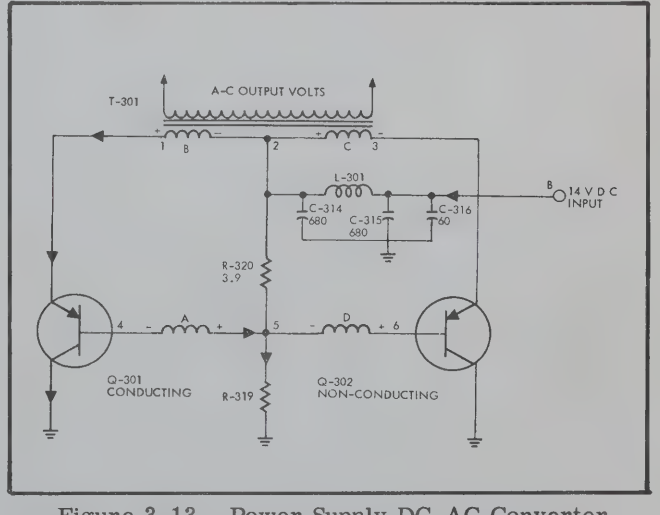


Figure 3-13. Power Supply DC-AC Converter, Simplified Schematic Diagram

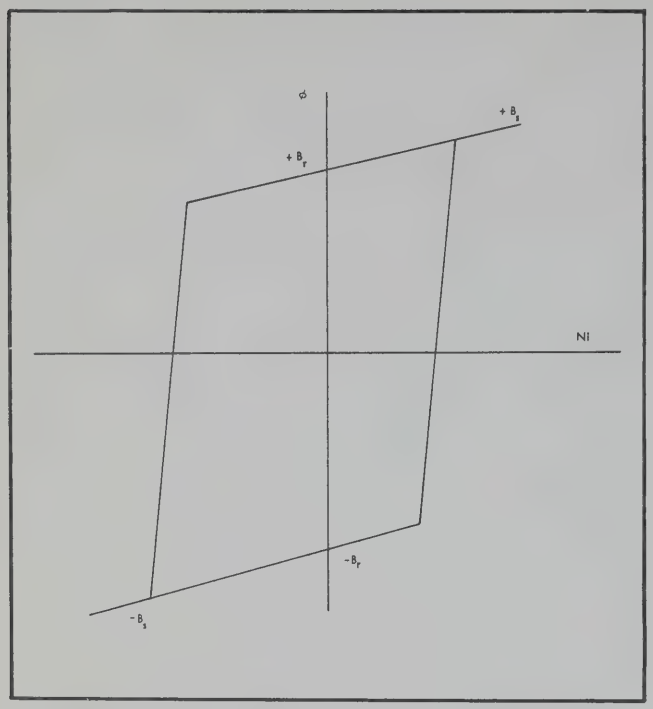


Figure 3-14. Hysteresis Curve of Saturable Reactor T-301

flux induces an emf in the primary windings of T-301, which is of opposite polarity to that which previously existed. This induced voltage makes the base of Q-302 negative with respect to its emitter, and at the same time drives Q-301 further into cut-off. Q-302 now commences to conduct, and the core becomes saturated in the opposite direction (-Bs in Figure 3-14), whereupon the cycle repeats itself. The output voltage that appears across the secondary winding is, therefore, a square-wave voltage with frequency and amplitude that is determined by the number of turns of the primary windings and the saturation flux of the core.

d. Rectifier Circuits (See Figure 3-15)

The full a-c voltage across the secondary of T-301 is rectified in a conventional full-wave bridge rectifier consisting of diodes CR-302, CR-303, CR-304, and CR-305. The 290-vdc nominal output of the rectifier is filtered by r-f choke L-302 and capacitors C-313A and C-313B, and serves as B+ voltage for the amplifier-modulator, the VOR and localizer converters, and the vhf transmitters. When transmit-receive relay K-301 is in the "receive" position, half the d-c voltage developed in the bridge rectifier is applied from tap 8 on the transformer secondary to pin H on connector P-301, through a CR filter consisting of resistor R-323 and capacitors C-313C and C-313D. This voltage serves as B+ for the vhf and marker-beacon receivers.

The alternating voltage between pins 7 and 8 (150 vac) is applied through capacitor C-312 and resistor R-316 to reverse-connected diode CR-301, which functions as a half-wave rectifier to provide negative bias for the grids of audio push-pull amplifier V-302 and V-303. The negative d-c output of CR-301 is filtered by capacitor C-311 and dropped to the required value of -30 vdc by voltage-divider R-314 and R-313.

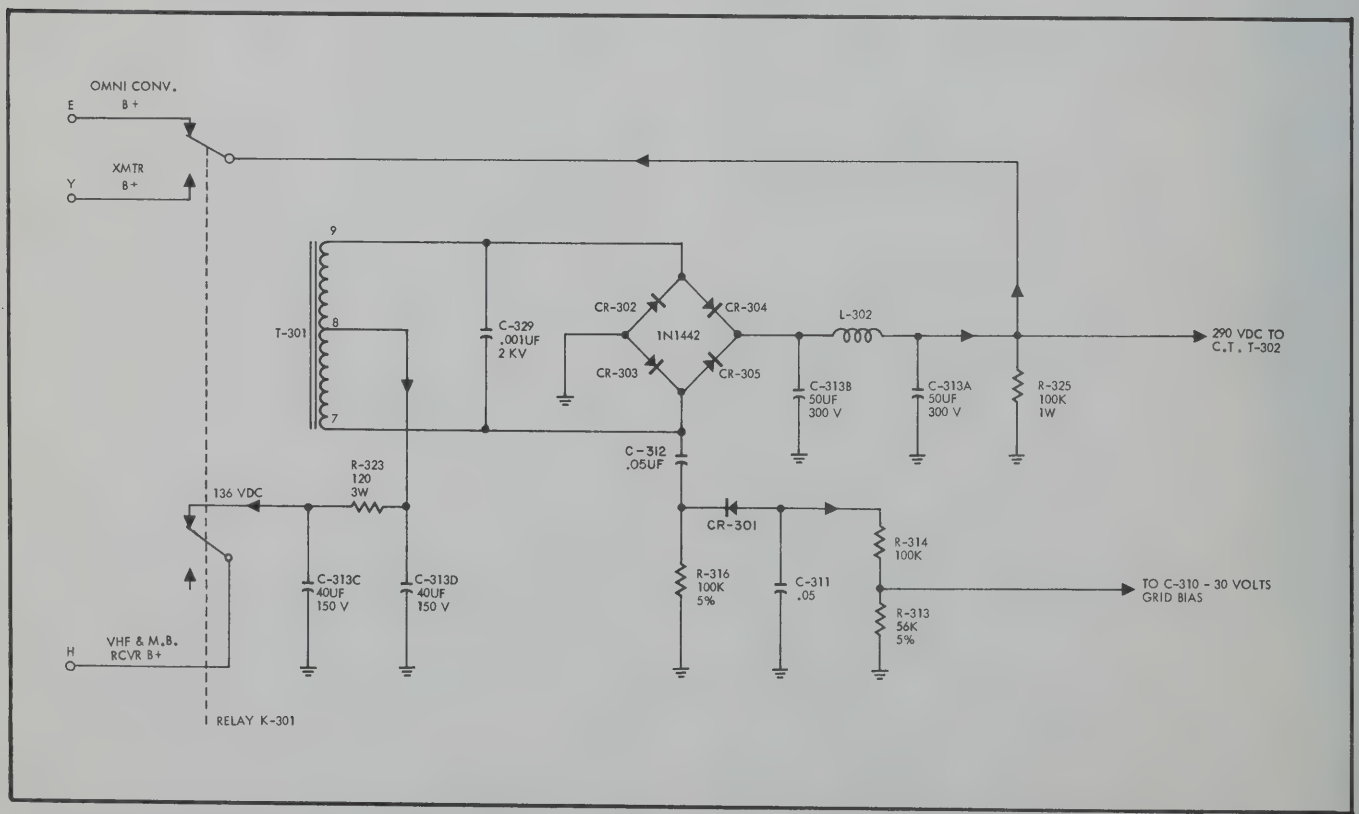


Figure 3-15. Power Supply Rectifier Circuits, Simplified Schematic Diagram

The power supply also supplies microphone bias voltage. This is accomplished by connecting the primary d-c supply voltage from terminal B to terminal M on connector P-301 through a filter consisting of resistors R-317, R-312, and capacitors C-308 and C-320.

e. Transmit-Receive Relay K-301 (See Figure 3-16)

The primary d-c supply voltage is connected to the coil of relay K-301, which is in series to ground through the button-switch on the microphone handset. Depressing the switch to the TRANSMIT position energizes the relay. When energized, the relay performs the following switching functions:

(1) Transfers the audio amplifier input circuit from the output of the vhf receiver to the microphone.

(2) Disconnects the loudspeaker from the output of the audio amplifier.

(3) Transfers the 290-vdc nominal B+ voltage from the navigation converter to the vhf transmitter.

(4) Increases the forward-bias on transistors Q-301 and Q-302 by switching from voltage-divider R-319 and R-320 to voltage-divider R-321 and R-322 in the power supply circuit.

(5) Removes the 135-vdc nominal B+ voltage from the vhf and marker-beacon receivers.

3.3.3 Audio Amplifier (See Figure 3-17)

In the RECEIVE position of transmit-receive relay K-301, the audio output of the vhf receiver is coupled to the grid of triode V-301A through capacitor C-302 and grid-return resistor R-303. The amplified output of V-301A is coupled to the grid of output amplifier V-302 through coupling capacitor C-303 and grid-return resistors R-307 and R-327. The voltage-divider formed by R-307 and R-327 applies approximately three percent of the input voltage to V-302

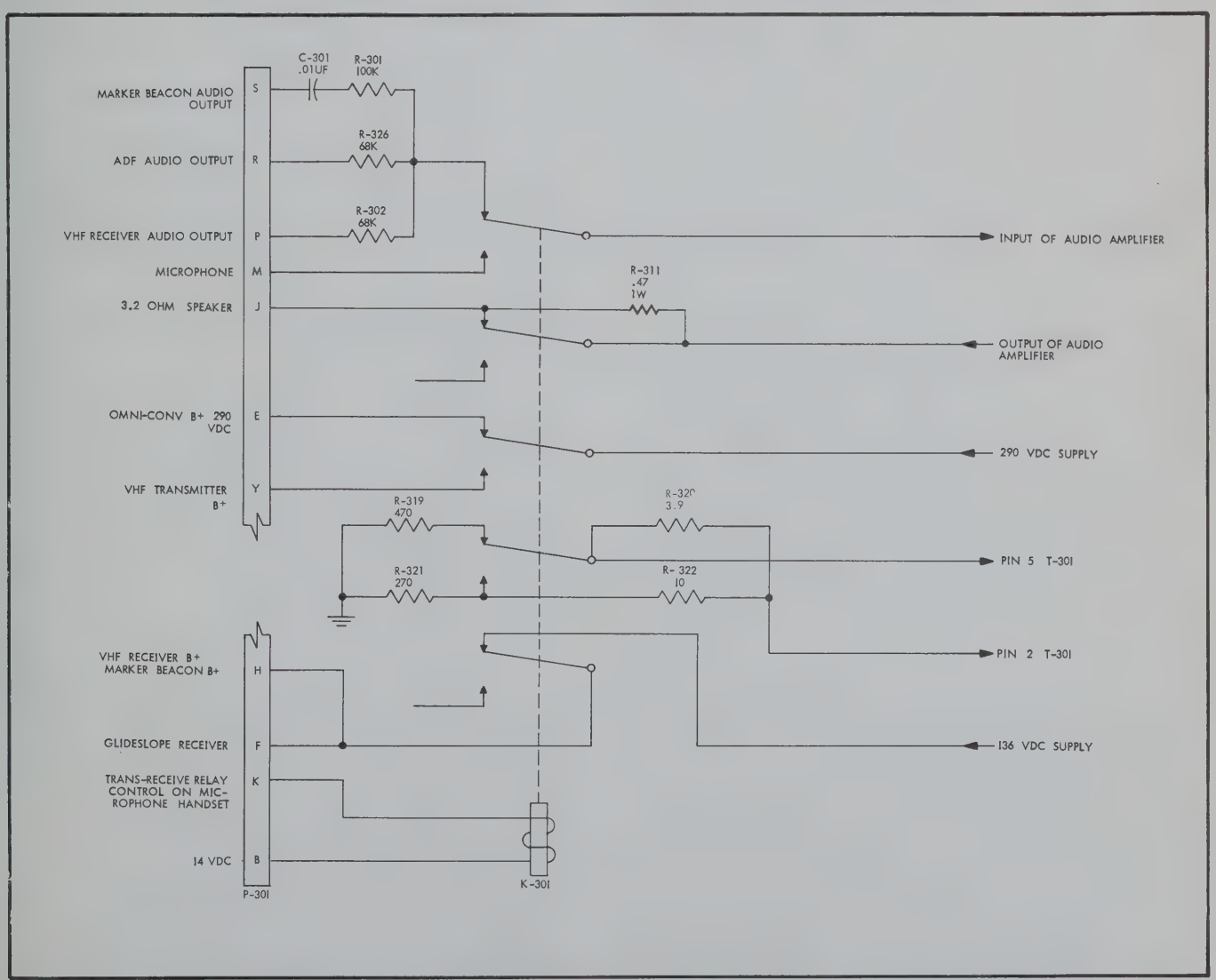


Figure 3-16. Power Supply TRANSMIT-RECEIVER RELAY K-301

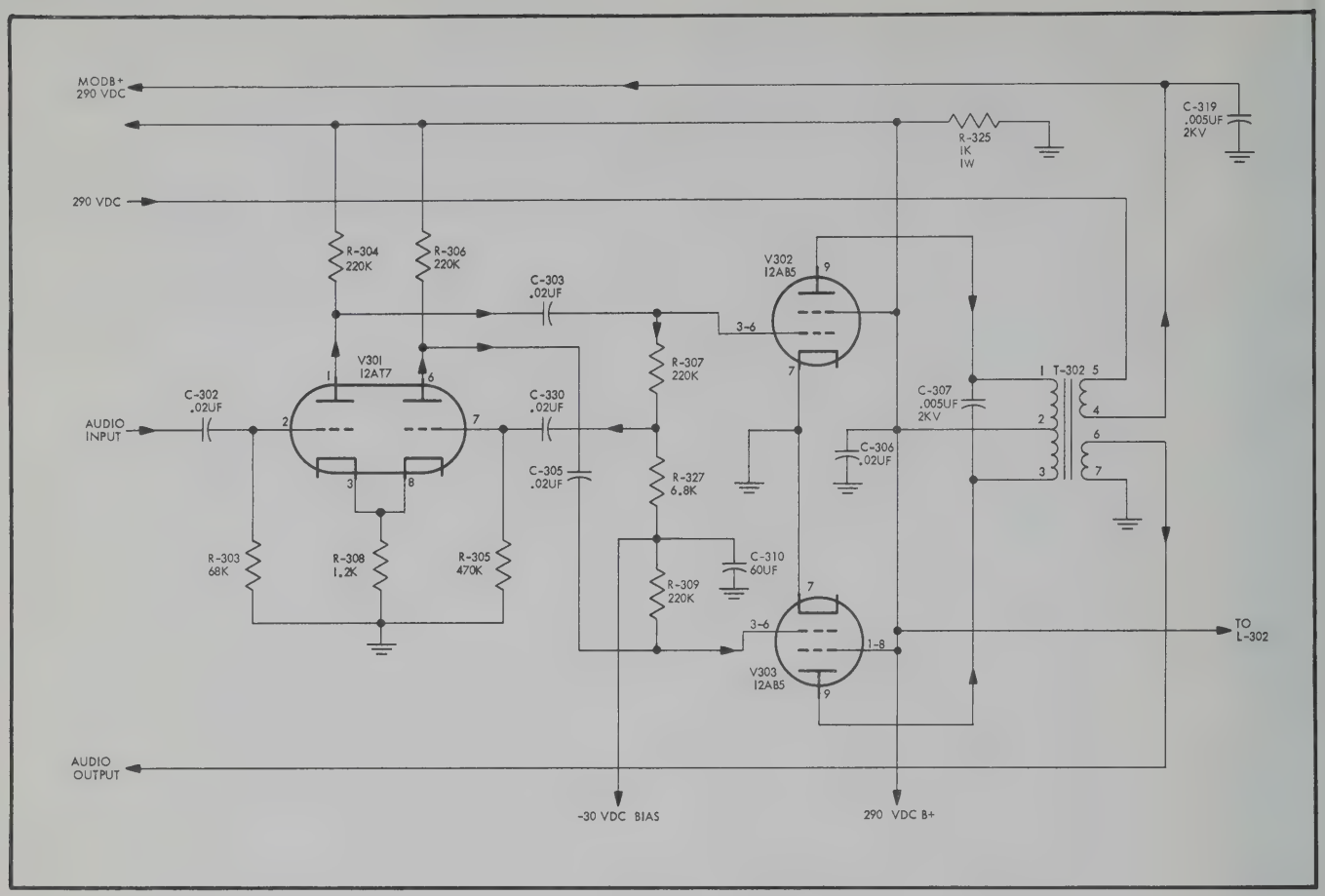


Figure 3-17. Audio Amplifier-Modulator, Simplified Schematic Diagram

back to the input of V-301B through coupling capacitor C-330 and grid-return resistor R-305. The amplified output of V-301B is coupled to the grid of output amplifier V-303 through coupling capacitor C-305 and grid-return resistor R-309. Capacitor C-310 maintains the junction of R-309 and R-327 at ground potential for r-f signals. As a result of the foregoing the input signals to the push-pull amplifier are 180 degrees out of phase as required for push-pull operation. The speaker winding (pins 6 and 7) of output transformer T-302, delivers audio power to a 3.2-ohm speaker through terminal J of connector P-301, when relay K-301 is in the RECEIVE position.

3.3.4 Modulator

In the TRANSMIT position of relay K-301, the audio amplifier described in the previous paragraph operates as a speech-amplifier/plate modulator for the vhf transmitter. Operation of the amplifier is essentially the same as in the former case, with the difference that the input and output connections are changed by operation of relay K-301. In the TRANSMIT position of the relay the 290 vdc nominal is applied to the plate of the final amplifier stage in the vhf transmitter through the secondary modulator winding (pins 4 and 5) of output transformer T-302. In this manner input power to the final stage of the transmitter is modulated in accordance with the audio voltage variations produced by the microphone.

3.4 MODEL 2374 VOR-LOCALIZER-MARKER BEACON RECEIVER

3.4.1 General

The Model 2374 module contains three separate circuit functions in a single package. These are a VOR converter, a localizer converter, and a 75-mc marker beacon receiver. The three functions are described separately in Paragraphs 3.4.2, 3.4.3, and 3.6, respectively.

3.4.2 VOR Converter

a. Introduction

The VOR converter is a two-channel phase-sensitive amplifier that separates, amplifies, and determines the existing phase-difference between the two 30-cps modulation components of a selected VOR composite signal. The two channels are referred to as the "reference phase" and the "variable phase" channels respectively. The output of the reference channels provides the reference-phase signal input to a phase-sensitive demodulator. The output of the variable-channel provides the variable-phase signal input to the demodulator. The d-c output of the demodulator is proportional in magnitude and polarity to the phase-difference between the two 30-cps input signals. This d-c output voltage energizes a d-c

meter movement in the Model 4087A navigation indicator to provide a visual indication of the degree of phase imbalance between the two channels.

The variable channel includes an inductive resolver that enables manual adjustment of the phase of the variable-channel signal with respect to the reference-channel signal. The resolver consists of a rotor coil inductively coupled to two stator coils in such a manner that the output voltage from the stator coils differs in phase from the input voltage to the rotor coil by an angle proportional to the angle of rotation of the rotor with respect to the stators from a zero reference position. An azimuth card, calibrated in two-degree increments from 0 through 360 degrees is mechanically linked to the rotor coil. The resolver is physically located in the Model 4087A navigation indicator but electrically connected in series with the variable-phase channel. Selection of a desired VOR radial consists of tuning the vhf receiver to the frequency of the desired VOR transmitter, and manually rotating the resolver rotor and attached azimuth card until the bearing of the selected radial on the azimuth card is read against a fixed pointer. Electrically, this rotation of the resolver rotor introduces a phase-shift in the variable channel with respect to the reference channel that compensates for the phase-difference existing between the two 30-cps modulation components of the selected VOR transmission. Thus, when the aircraft attains and flies the selected radial bearing, the reference and variable channel amplifiers are effectively in phase. Under these conditions the output of the phase-sensitive demodulator is zero volts d-c and the meter-pointer in the navigation indicator is centered. In addition, should the aircraft attain an undesired radial by veering to the right or left of the desired radial, the phase-relationship of the modulation components becomes unbalanced. This produces a proportional d-c output from the demodulator that causes the meter-pointer to deflect. The extent and direction of this deflection indicates to the pilot the heading correction required to re-attain the desired radial.

In actual practice the phase-shift introduced into the variable channel by the resolver does not bring the reference and variable signals into phase. Instead, it establishes a quadrature-phase relationship between them (90 degrees out of phase). This is due to the fact that the phase-sensitive demodulator circuit requires two input signals that are 90 degrees out of phase to produce a zero d-c output level. This additional 90-degree phase-shift from the in-phase condition is developed throughout the variable-phase channel, partly in the resolver and partly in the remaining circuitry.

b. Input Circuits (See Figures 3-18 and 3-19)

When tuned to a VOR omni-range frequency, the output of the second detector in the vhf receiver consists of a 9960-cps sub-carrier signal that is frequency-modulated with a deviation ratio of 16 at 30 cps. In addition, the zero level of the sub-carrier is varied in amplitude at 30 cps. This composite sub-carrier signal is conducted from the vhf receiver through a shielded lead to the VOR converter, where it is coupled to the input of composite-signal amplifier V-401A by coupling capacitor C-404 and grid-return resistor R-406. Series grid resistor R-405 serves to stabilize the amplitude of the 30-cps amplitude variation of the sub-carrier zero level, before the signal reaches the resolver rotor. The amplified output of V-401A is then separated by appropriate filter circuits into its amplitude and frequency-modulation components. The frequency-modulation component, consisting of the 9960-cps sub-carrier frequency-modulated at 30 cps is coupled to the reference channel; the amplitude-modulation component, consisting of the 30-cps amplitude variations of the 9960-cps sub-carrier zero-level voltage is coupled to the variable channel.

c. Reference Phase Channel (See Figure 3-18)

Separation of the 30-cps amplitude variation from the 30-cps frequency-modulated sub-carrier is accomplished in the plate-circuit of V-401A by coupling capacitor C-414 and a resonant filter consisting of inductance L-401 and capacitor C-415. Capacitor C-414 presents a high impedance to 30-cps amplitude variations but allows the 9960-cps sub-carrier and its modulation components to pass through with negligible attenuation. In addition, the resonant filter (L-401 and C-415) which is tuned to the sub-carrier frequency provides a high-impedance input to the following stage (V-402A) for the sub-carrier frequency, and a virtual short-circuit to ground for 30-cps signals. Due to the band-pass characteristics, the action of the resonant filter on the frequency-modulated sub-carrier signal causes a small amount of delay and introduces some amplitude modulation. To compensate for this, resistor R-417 is placed in series with the grid circuit of limiter-amplifier V-402A to provide amplitude limiting.

Resistor R-417 also maintains the input impedance of V-402A at a high level for d-c components generated by grid-current flow.

The amplified output of V-402A, consisting of a constant-amplitude 30-cps frequency-modulated sub-carrier signal, is coupled to a tuned-parallel slope detector circuit through coupling capacitor C-412. The slope detector consists of the parallel resonant circuit formed by inductance L-402 and capacitor C-413, which is tuned to resonance at a frequency somewhat above that of the sub-carrier (Approximately 14 kc). This being the case, the f-m spectrum of the sub-carrier signal (9960 plus or minus 480 cps) falls on the low-frequency shoulder of the resonance curve and generates amplitude modulation as a function of the deviation ratio of the signal and the Q of the resonant circuit. Thus the constant-amplitude frequency-modulated sub-carrier signal at the plate of V-402A is translated to a 30-cps amplitude-modulated sub-carrier signal at the junction of capacitor C-412 and the parallel resonant slope-detector circuit. This latter signal is demodulated by diode detector V-402B. The 30-cps component of the demodulated signal appears across diode load resistor R-469. Capacitor C-418 serves as a bypass capacitor for the 9960-cps components. Additional filtering for the 9960-cps components is provided by a low-pass filter consisting of resistor R-416 and capacitor C-426.

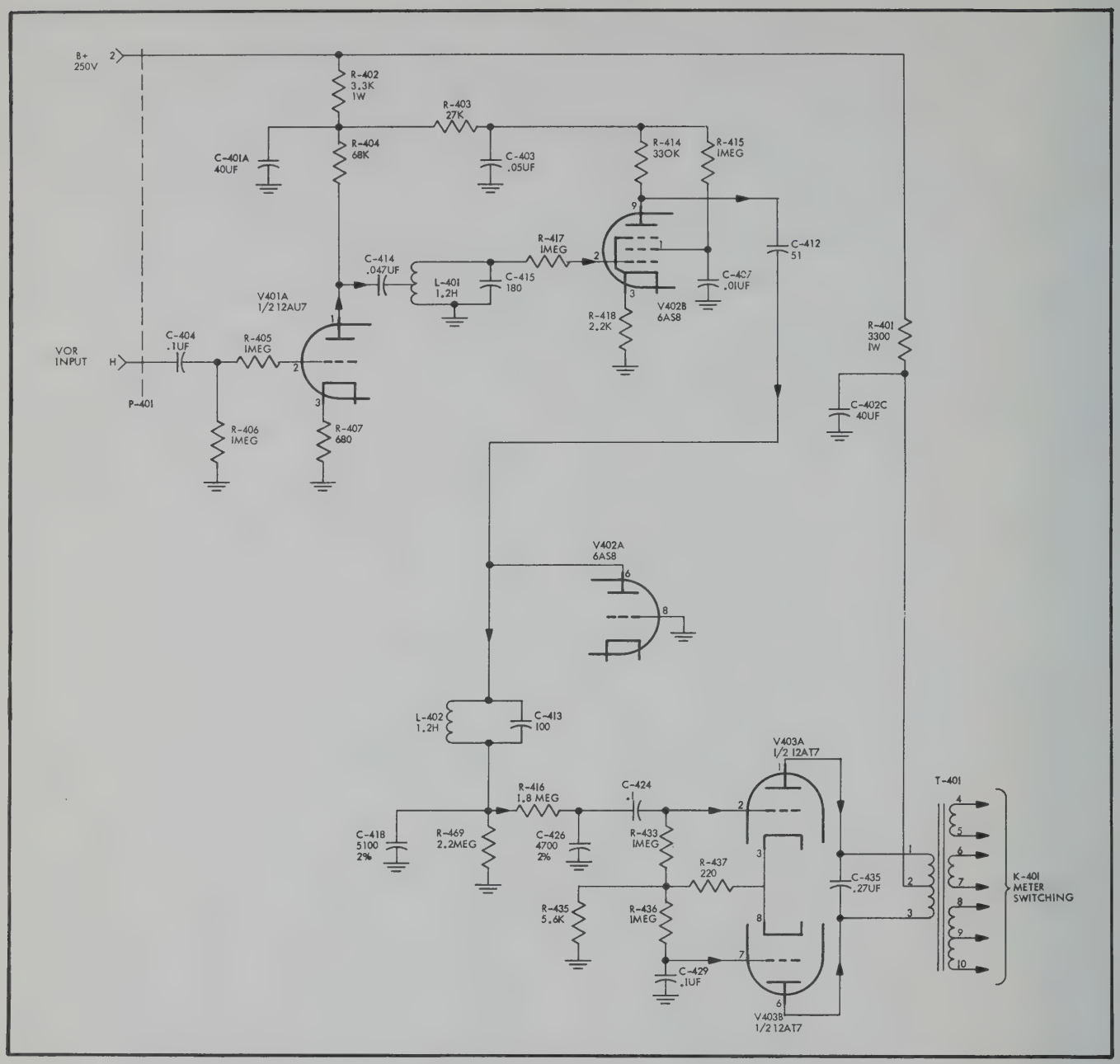


Figure 3-18. VOR Converter Reference Phase Channel, Simplified Schematic Diagram

The filtered 30-cps reference signal is applied to push-pull amplifier V-403A and V-403B through a phase-splitting network consisting of C-424, R-433, R-436, C-429, and common cathode resistors R-437 and R-435. The phase-splitting network functions to provide inputs to push-pull stages V-403A and V-403B that are 180 degrees out of phase. The 30-cps reference signal is developed across R-433 and applied directly to the grid-cathode input of V-403A. The output of V-403A is developed across cathode resistors R-433 and R-435 and provides the cathode-grid input (grid of V-403B grounded for a-c through C-429) to V-403B. Thus V-403A is operated as a cathode-follower and V-403B as a grounded-grid amplifier to provide the required 180-degree out-of-phase condition for push-pull operation. The amplified output of the push-pull amplifier is applied to the phase-sensitive demodulator through output transformer T-401. The primary of T-401 is tuned to approximately 25 cps by capacitor C-435. This improves the stability and lowers the distortion of the output stage.

d. Variable Phase Channel (See Figure 3-19)

The 30-cps amplitude component of the composite VOR signal is coupled from the plate of V-401A to the grid of cathode-follower V-401B through coupling capacitor C-419, a variable phase-shift network, and a low-pass CR filter. The variable phase-shift network, consisting of capacitor C-438, resistor R-448, and potentiometer R-432, enables adjustment of the

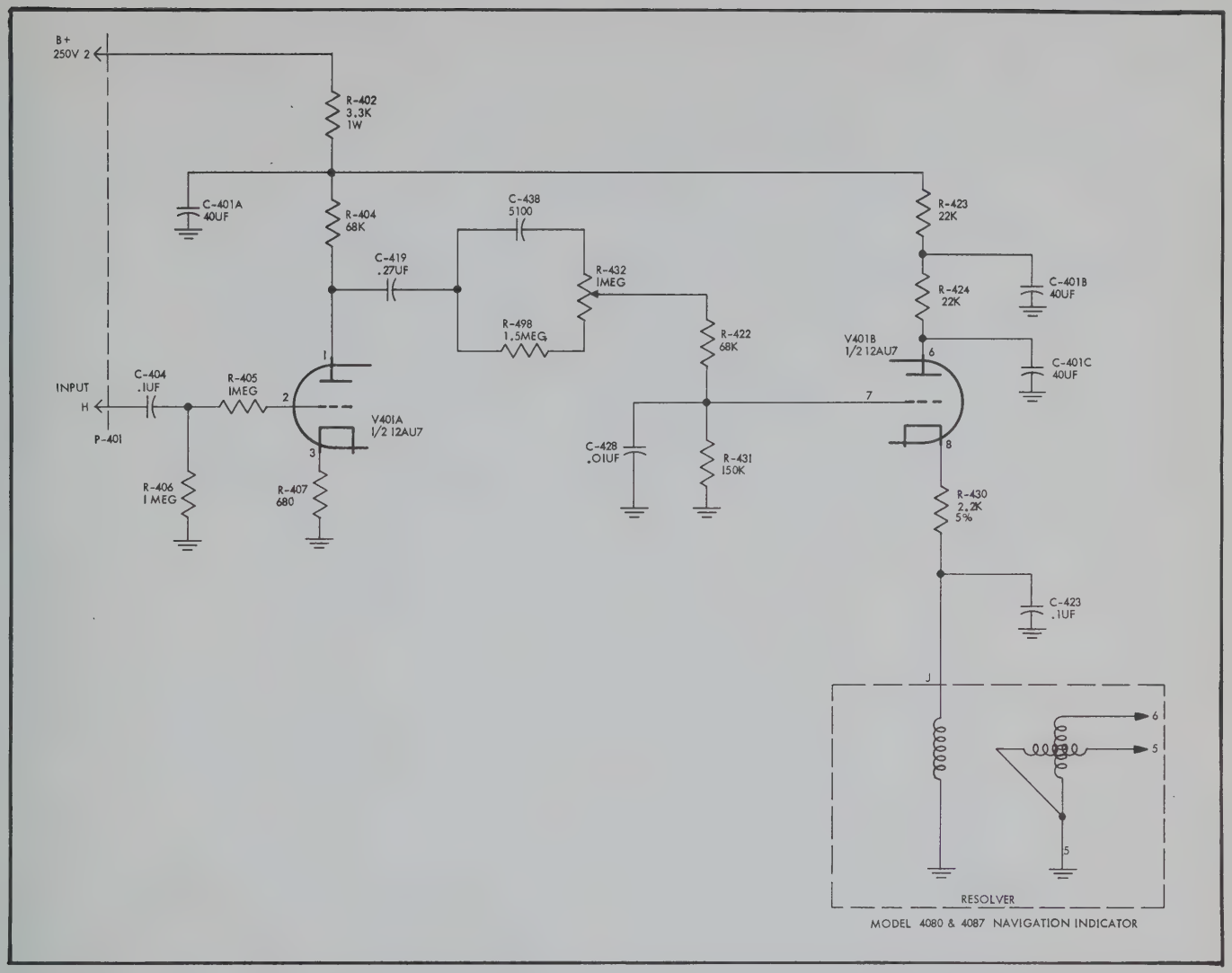


Figure 3-19. VOR Converter Variable Phase Channel Input Circuits, Simplified Schematic Diagram

phase-shift of the variable channel for alignment and calibration purposes. The low-pass filter, consisting of resistor R-422 and capacitor C-428, presents a high impedance to the 30-cps component, and a low impedance to the 9960-cps component of the composite VOR signal. In addition, the CR filter introduces a fixed amount of phase-shift into the variable channel. The filtered 30-cps variable-phase signal is developed across R-431 and applied to grid of cathode-follower V-401B. V-401B functions as an impedance transformer to couple the high impedance output of V-401A to the low-impedance rotor winding of the resolver rotor winding. Cathode resistor R-430 is in series with the low-resistance resolver rotor and serves as a swamping resistor to provide constant current-resolver input, thereby minimizing the effects of signal-amplitude variations, and variations in the copper-winding resistance of the rotor.

(1) Resolver (See Figure 3-20)

The resolver consists of a primary rotor winding magnetically coupled to two stator windings. The stator windings are wound inside a cylindrical form with the two coil axes at right angles to each other. The function of the resolver (and associated circuitry, C-433 and R-443) is to shift the phase of the output voltage across the two stators from that of the rotor input voltage by an amount proportional to the angle of rotation of the rotor from a zero reference position. This reference position is established when the rotor winding is parallel to one of the stator windings and at right angles to the other. Under these conditions the rotor, R-1, induces maximum voltage in stator S-1, and zero voltage in stator S-2. The total stator output voltage is the algebraic sum of the voltages induced in the individual stators. As the rotor is rotated with respect to the stators, the voltage induced in the individual stators varies proportionally. The windings of the resolver are connected in such a manner that the stator output voltage is in phase with the rotor input voltage. Thus the output of the resolver is a voltage that is in phase with the input voltage, but the magnitude of which varies in proportion to the angular rotation of the rotor with respect to the stators.

For correct VOR operation a resolver output voltage is required, the phase of which varies with the angular rotation of the rotor, but the amplitude

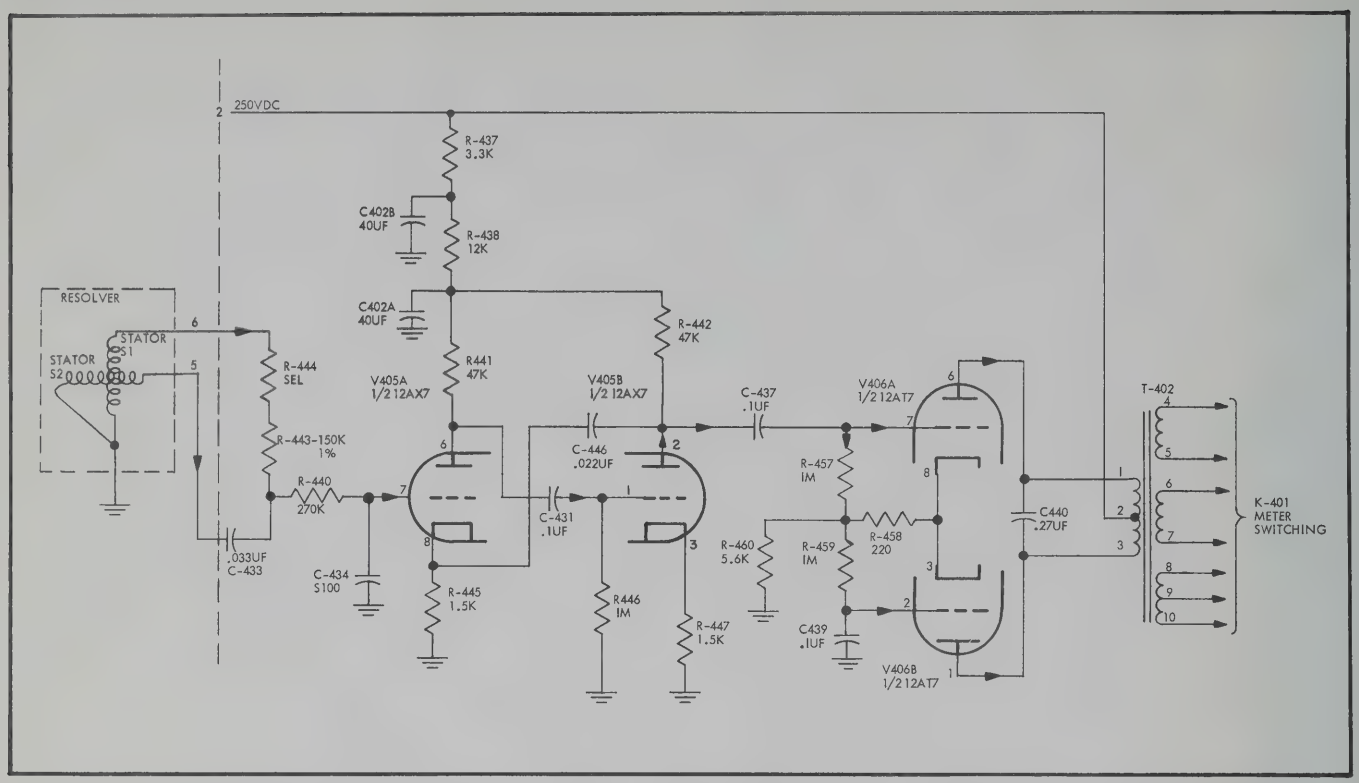


Figure 3-20. VOR Converter Variable Phase Channel Output Circuits, Simplified Schematic Diagram

of which remains constant. To accomplish this requirement, capacitor C-433 and resistor R-443 are connected across the stator windings to form a phase-shift bridge circuit. (See Figure 3-20.) The current through C-433, due to the voltage in stator S-1, is shifted in phase by 90 degrees, while the current through R-443, due to the voltage in stator S-2, is in phase with the applied voltage. The resultant voltage output to the grid of amplifier V-405A is the vector sum of these two components (IR and IX), and consists of a voltage of constant amplitude, the phase of which varies in proportion to the angular rotation of the rotor with respect to the stators. Resistor R-440 and capacitor C-434 function as a low-pass filter section to attenuate any higher-order frequencies generated in the resolver due to the constant current excitation of the resolver rotor. The 30 cps output from the low-pass filter is amplified in two stages by V-405A and V-405B. Capacitor C-466 provides negative feedback from the plate of V-405B to the cathode of V-405A to further attenuate higher-order frequency components and stabilize the gain of the amplifier. The amplified 30-cps output of V-405B is coupled to push-pull amplifier V-406A and V-406B through the phase-splitting network consisting of C-437, R-457, R-459, C-439, and cathode resistors R-458 and R-460. The phase-splitting network functions to provide inputs to push-pull stages V-406A and V-406B that are 180 degrees out of phase, and is similar in principle to that described in paragraph 3.4.2b. The amplified output of the push-pull amplifier is applied to the phase-sensitive demodulator through output transformer T-402. The primary of T-402 is tuned to approximately 25 cps by capacitor C-440 to lower the distortion and improve the stability of the output stage.

e. Phase-Sensitive Demodulator Circuit (See Figure 3-21)

(1) Right-Left Deviation Circuit

The phase-sensitive demodulator circuit consists of two full-wave bridge rectifiers, the d-c outputs of which are connected in series opposition through load resistors R-450, R-455, and R-453. Each bridge rectifier has two inputs, one from the reference channel, the other from the variable-phase channel. Transformers T-401 and T-402 are wound in such a manner that the two voltage inputs to the bridge rectifiers are series aiding in one case and series bucking in the other. The magnitudes of the two signal inputs are equal, while the phase difference between them varies in proportion to the right-left deviation of the aircraft from the selected VOR radial. When the aircraft is flying the selected VOR radial, a 90-degree phase difference exists between the reference and variable phase input signals.

Assume initially that the aircraft is flying at an angle of 90 degrees to the desired radial. In this case the reference and variable phase inputs to the bridge rectifiers are either in phase or 180 degrees out of phase. Assume the former condition to be the case, i.e., the two inputs are in phase. Windings 4 and 5 of T-401 and 6 and 7 of T-402 are connected in a series-bucking configuration. Thus the net voltage between tap 4 of T-401 and tap 7 of T-402 is zero. Windings 6 and 7 of T-401 and 4 and 5 of T-402 are connected in a series-aiding configuration. Thus the net voltage between tap 6 of T-401 and tap 5 of T-402 is the sum of the two inputs. The d-c outputs of the two bridge rectifiers are connected in

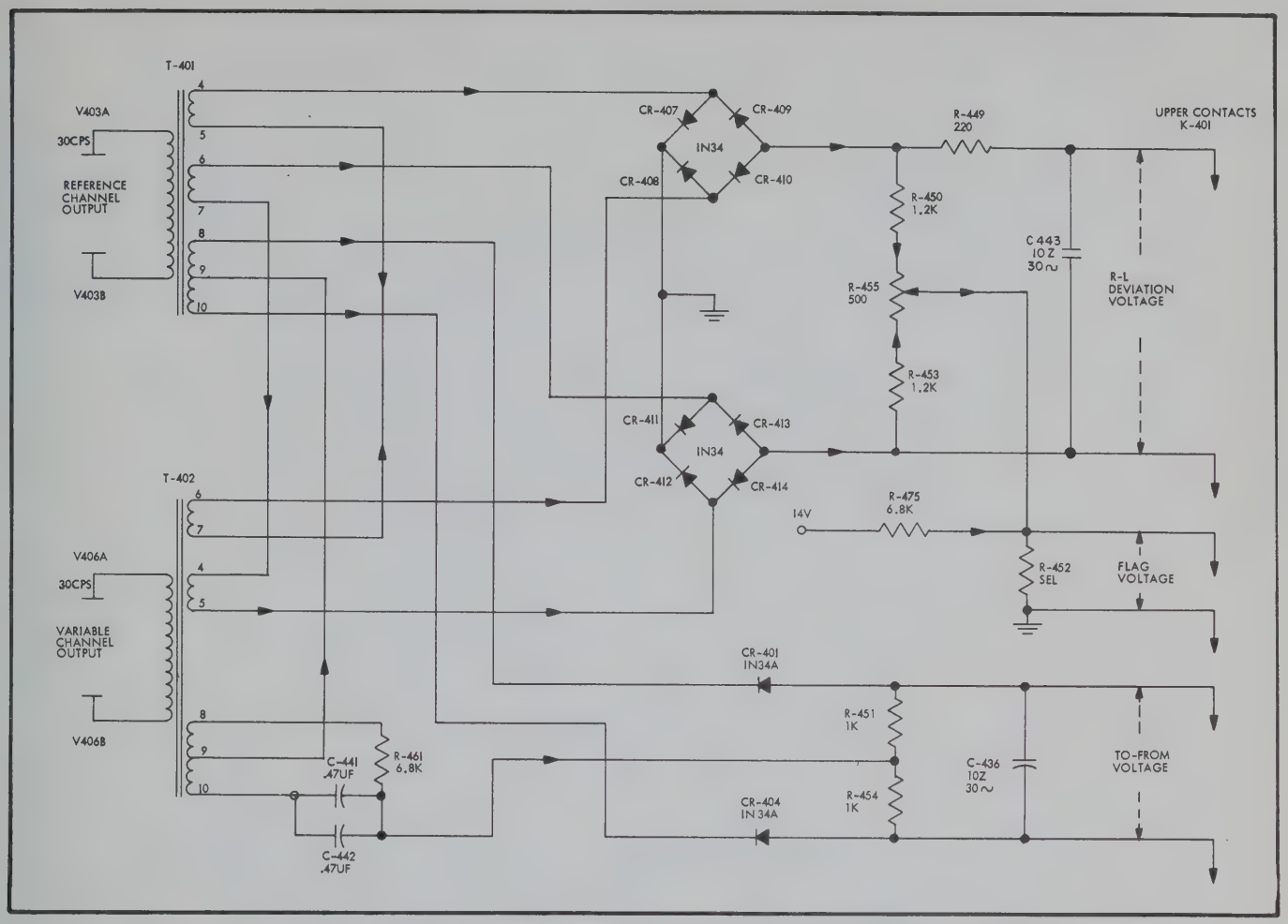


Figure 3-21. VOR Converter Phase Sensitive Demodulator, Simplified Schematic Diagram

series opposition through load resistors R-450, R-455, and R-453. Under these conditions, therefore, the circuit is unbalanced, and the pointer of the d-c meter movement will be deflected. This deflection indicates to the pilot that a change of heading is required to attain the desired VOR radial. A similar situation exists if the two input signals are 180 degrees out of phase, except that in this case the circuit is unbalanced in the opposite direction. When the aircraft is flying the desired radial the output of each bridge rectifier consists of a pulsating d-c voltage, each of opposite polarity to the other, that passes through the load resistors in opposite directions for each half-cycle of the applied a-c. The net or average d-c voltage as seen by by-pass capacitor C-443 is therefore zero over any one complete cycle of applied ac. As a result, the circuit is balanced and the right-left pointer centered.

(2) VOR Flag Circuit

The rectified d-c currents from both bridge rectifiers are combined in common-return resistor R-452. The voltage-drop across R-452 is applied to a second d-c meter movement in the Model 4087A navigation indicator that functions as a warning flag. Failure of either one of the two 30-cps inputs reduces the voltage-drop across R-452. As a result, the d-c meter movement is de-energized sufficiently to cause the warning flag to appear in an aperture on the face of the instrument. In order to assure positive operation of the flag when one input signal fails, a small amount of reverse d-c bias is applied to the two bridge rectifiers through a voltage-divider consisting of resistors R-475 and R-452.

f. TO-FROM Circuit (See Figure 3-22)

When the aircraft is flying a pre-selected VOR radial the right-left deviation pointer is centered, but an ambiguity exists as to whether the observed bearing is TO the station from the aircraft, or FROM the station to the aircraft. This is due to the fact that the phase-sensitive demodulator produces zero d-c output when the variable phase signal is 90 degrees out of phase with the reference phase signal, regardless of whether the former leads or lags by 90 degrees on the latter. This ambiguity is resolved by shifting the phase of the variable-phase signal by an additional 90 degrees and determining whether the resultant signal is in phase or 180 degrees out of phase with the reference phase signal. If the two signals are in phase the TO-FROM indicator reads TO; if they are 180 degrees out of phase it reads FROM.

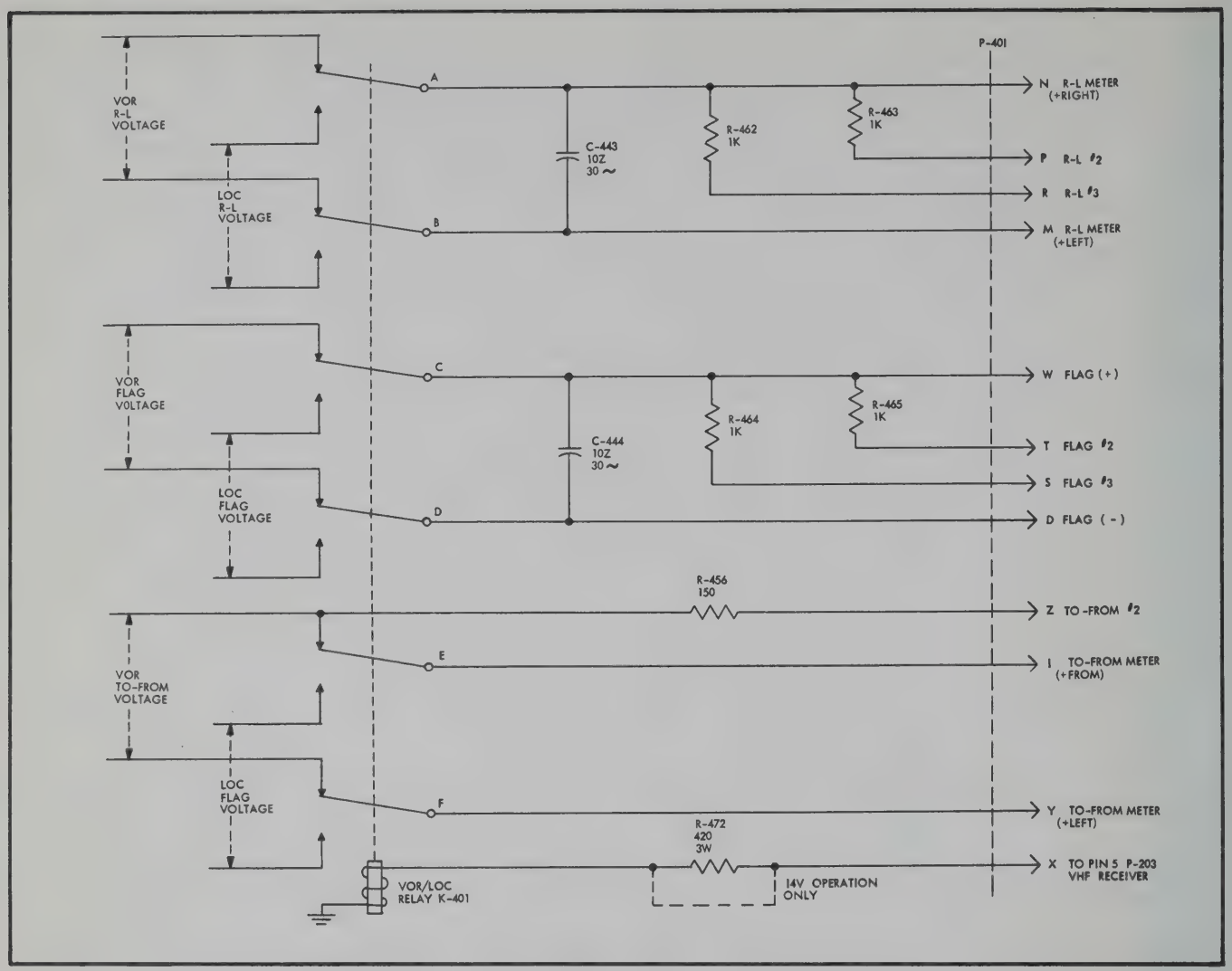


Figure 3-22. VOR-Localizer Relay K-401

Figure 3-23 is a simplified schematic of the TO-FROM circuit, which consists of a half-wave phase-sensitive demodulator. The reference phase input is applied to diodes CR-404 and CR-401 from windings 8 and 10 of transformer T-401. As a result, current flows through load resistors R-451 and R-454 in opposite directions during each half-cycle of the applied reference voltage. This is illustrated by vectors E-3 and E-4. The variable-phase voltage is applied to a phase-shift network consisting of resistor R-461 and parallel capacitors C-441 and C-442. The resistance of R-461 is equal to the reactance of the two capacitors at 30 cps. The voltages developed across R-461 and capacitors C-441 and C-442 (E-6 and E-7) add at right angles to produce E-5, which is 90 degrees out of phase with the variable-phase signal E-1, E-2. The voltage applied to rectifier CR-401 is the vector sum of E-3 and E-5 and is shown as E-9. The rectified current due to E-9 causes an IR drop in resistor R-451 with point A negative to point C. The voltage applied to rectifier CR-404 is the vector sum of E-4 and E-5 and is shown as E-8. The rectified current due to E-8 causes an IR drop in resistor R-454 with point B positive to point C. The algebraic sum of the two voltage drops across R-451 and R-454 is applied to the TO-FROM meter movement in the navigation indicator. When point A is more negative than B the indication is TO; when point B is more negative than A the indication is FROM.

3.4.3 Localizer Converter

a. Input Circuits (See Figure 3-24)

The composite 90- and 150-cps localizer signal is conducted from the vhf receiver through a shielded lead to the localizer converter section of the Model 2374 module. The signal is coupled to the grid of V-404A through coupling capacitor C-405 and resistors R-411 and R-412, which are returned to ground through avc filter capacitor C-408. Resistor R-411 and capacitor C-409 form a low-pass filter that attenuates any undesirable higher-frequency components. Additional attenuation of higher-frequency components is provided by negative feedback through capacitor C-406 from the plate to the grid of V-404A. The amplified output of V-404A is impressed across

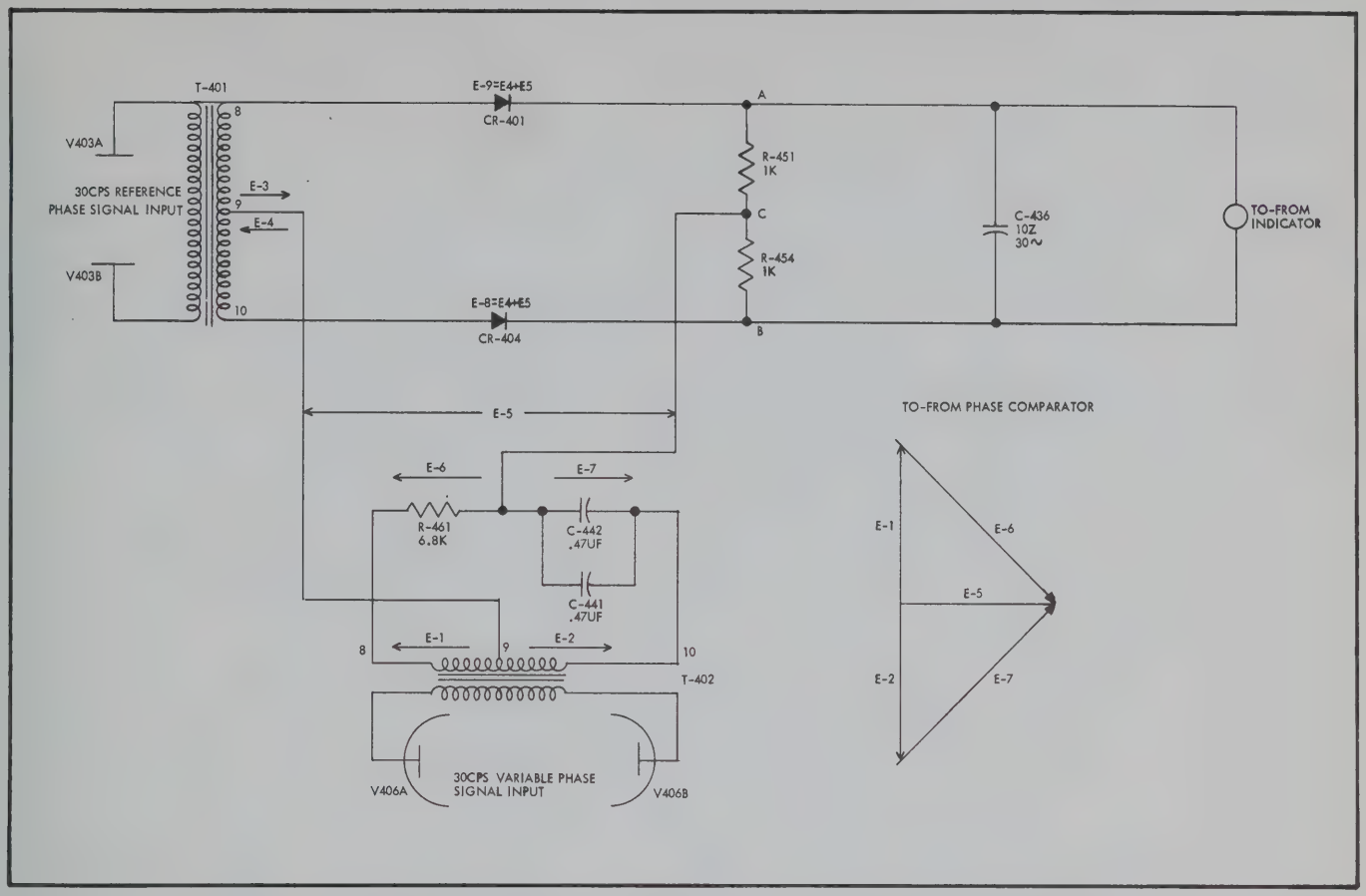


Figure 3-23. VOR Converter TO-FROM Circuit, Simplified Schematic Diagram

the parallel 90- and 150-cps resonant filters formed by L-403 and C-421, and L-404 and C-422 respectively. The outputs of the two resonant filters are connected to a half-wave rectifier consisting of diodes CR-405 and CR-406. The rectified current through CR-405 develops a voltage drop across load resistor R-426 with point A positive with respect to point C. The rectified current through CR-406 develops a voltage drop through resistor R-429 and potentiometer R-428 with point B positive with respect to point C. Thus the voltages developed in the two loads are in series opposition. If the voltage drops are equal, corresponding to equal-amplitude 90- and 150-cps components, there is zero potential difference between points A and B, and the right-left pointer in the navigation indicator remains centered. If the circuit becomes unbalanced due to the 90-cps component being of greater amplitude than the 150-cps component, or vice versa, point A becomes more or less positive with respect to point B. The resulting potential difference between points A and B causes the right-left pointer to deflect to the right or left accordingly.

b. Localizer Flag Circuit

Resistor R-427 is included in the common ground return of both rectifiers and thus carries the rectified d-c current of both diodes. The flag-alarm d-c meter movement in series with resistor R-473 is connected across R-427. If either or both of the two input signals should fail, the voltage drop across R-427 is insufficient to hold the flag down, and as a result the flag appears in an aperture on the front of the instrument. When the navigation module is used in conjunction with the Model 4080A navigation indicator, the VOR TO-FROM d-c meter movement is used as the flag alarm for localizer operation. In this case resistor R-434 is inserted in series with R-473 and the d-c meter movement.

3.4.4 VOR-Localizer Relay K-401 (See Figure 3-22)

VOR-LOC relay K-401 functions to automatically switch the navigation indicator instruments from the VOR converter to the localizer converter circuits, whenever the Model 5611A module is tuned to a localizer channel. In the de-energized state relay K-401 connects the VOR converter circuits to the navigation indicator. When the Model 5611A module is tuned to a localizer channel, a circuit through the coil of K-401 is completed to ground through the wafers on megacycle and tenth-megacycle control switches of the Model 5611A module.

3.5 MODELS 4080A AND 4087A NAVIGATION INDICATORS (See Figure 3-25)

The Model 4080A navigation indicator contains two dual-purpose d-c meter movements and an inductive resolver. When operating in the VOR mode, the

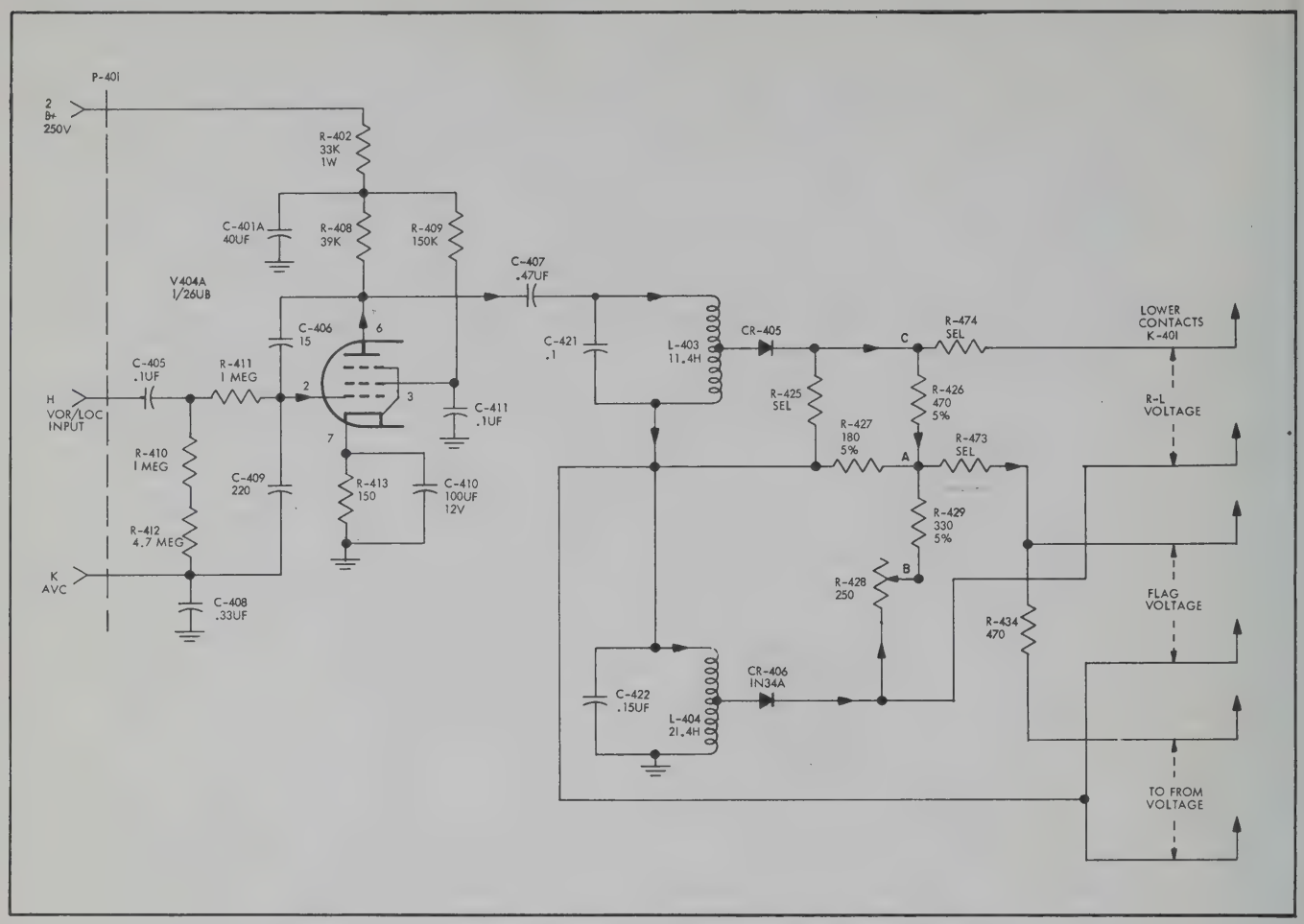


Figure 3-24. Localizer Converter, Simplified Schematic Diagram

right-left d-c meter indicates the right-left deviation of the aircraft from the selected VOR radial. The TO-FROM d-c meter movement indicates whether the observed bearing is TO the station from the aircraft, or FROM the station to the aircraft. In the localizer mode of operation the right-left meter functions in a similar manner to indicate the right-left deviation of the aircraft from the center of the localizer beam. The TO-FROM meter, however, is used as a flag-alarm indicator.

The Model 4087A navigation indicator is used when a glideslope receiver is included in the LNC-100 System. The unit includes the same components as the Model 4080A navigation indicator plus three additional d-c meter movements. Two of these are operated from a glideslope receiver. The third meter provides a separate flag-alarm indicator for the VOR and localizer modes of operation.

3.6 75 MC MARKER BEACON RECEIVER (See Figure 3-26)

The marker-beacon receiver is a circuit function packaged in the Model 2374 module, the other functions of which are described in paragraph 3.4

3.6.1 Receiver Circuits

The 75-mc marker-beacon receiver consists of a conventional three-stage fixed-tuned t-r-f receiver. The audio-modulated 75-mc marker-beacon signals are applied to the grid-plate tuned r-f amplifier V-407B. The amplified output of V-407B is transformer-coupled to the input of grid-leak detector V-407A. The demodulated audio output of V-407A is coupled through C-416 and grid-return resistor R-419 to the grid of cathode-follower output amplifier V-404B. The audio voltage developed at the cathode of V-404B is fed to the three-stage audio-power amplifier located in the Model 2355 module, for further amplification and reproduction in the loudspeaker. The d-c component of the demodulated signal is applied to the grid of r-f amplifier V-407B for automatic volume control, through a filter consisting of C-420 and R-467.

3.6.2 Indicator Lamp Circuit (See Figure 3-27)

The C-1 and D-1 versions of the Model 2374 module include a single lamp indicator circuit for marker-beacon operation. The demodulated audio output of grid-leak detector V-407A is applied to a two-stage transistorized lamp amplifier consisting

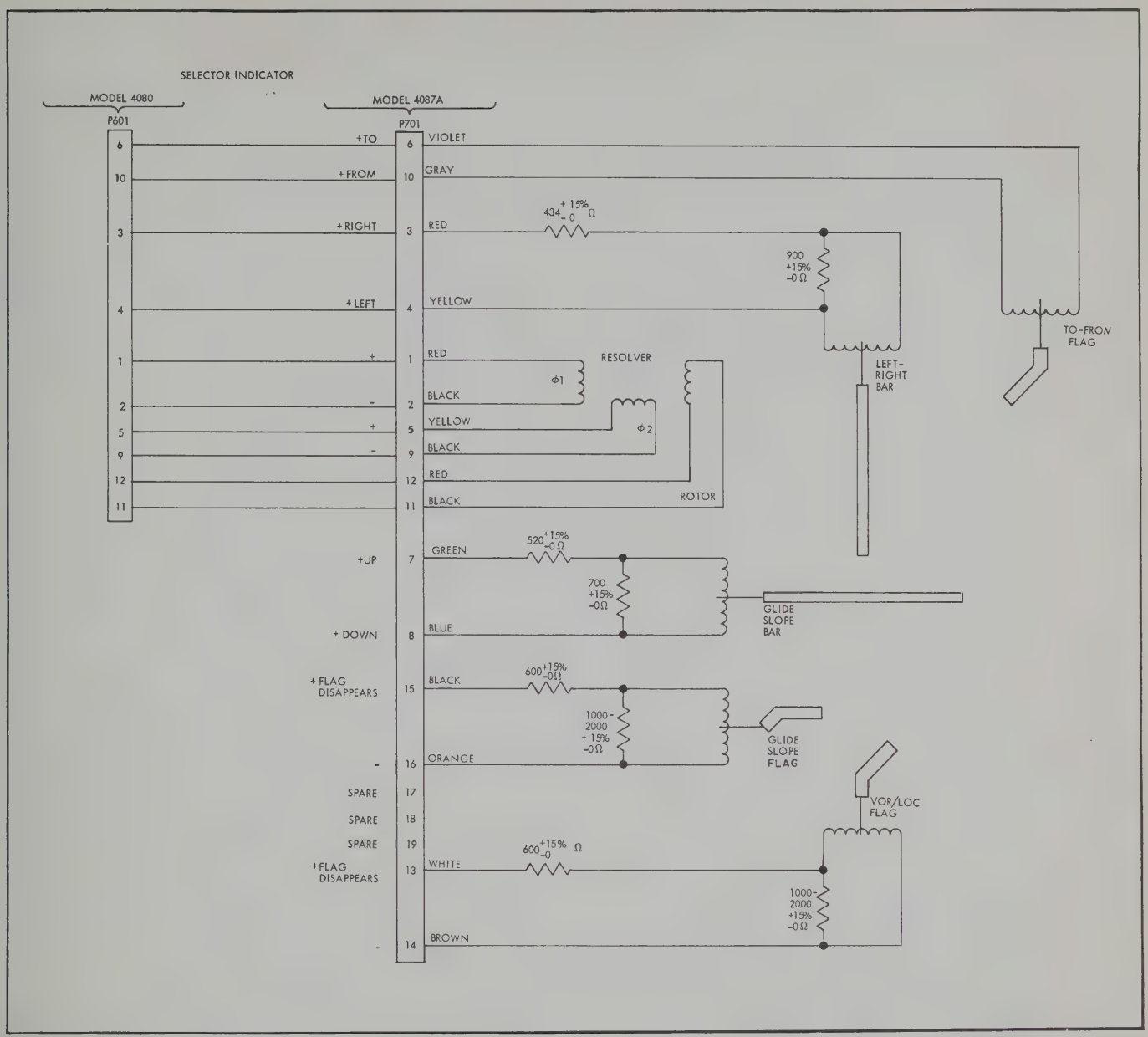


Figure 3-25. Models 4080 and 4087 Navigation Indicators, Simplified Schematic Diagram

of transistors Q-498 and Q-499 connected in a common-emitter circuit configuration.

The d-c biasing arrangement is such that under static conditions, i.e. with no signal input, transistor Q-498 is forward-biased and conducting in the neighborhood of saturation. This develops a high-voltage drop across collector load resistor R-497, which reduces the forward-bias on Q-499 until the transistor is almost cut-off. Under these conditions the lamp is unlit. The audio output of the receiver is coupled to the base of Q-498 through capacitor C-498. During the positive half-cycles of audio signal the forward-bias on Q-498 is reduced. This causes a reduced voltage drop across R-497 which in turn increases the forward-bias on Q-499, causing the transistor to conduct heavily. The collector current of Q-499 flows through the indicator lamp. During the negative half-cycles of the audio signal the process is reversed and the current through the lamp is cut-off. However, due to the frequencies involved in marker-beacon operation (400, 1300, and 3000 cps) the human eye cannot differentiate between the on and off conditions and the lamp appears to be lit continuously. Temperature compensation is provided by thermistor RT-499 in the biasing voltage-divider network. An increase in ambient temperature tends to increase the collector current of Q-499. The resistance of RT-499 decreases with an increase in ambient temperature and in so doing reduces the forward-bias on Q-499. This reduction in the forward-bias tends to reduce the collector current. The two effects thus cancel each other and maintain the collector current at a steady value for wide fluctuations in ambient temperature.

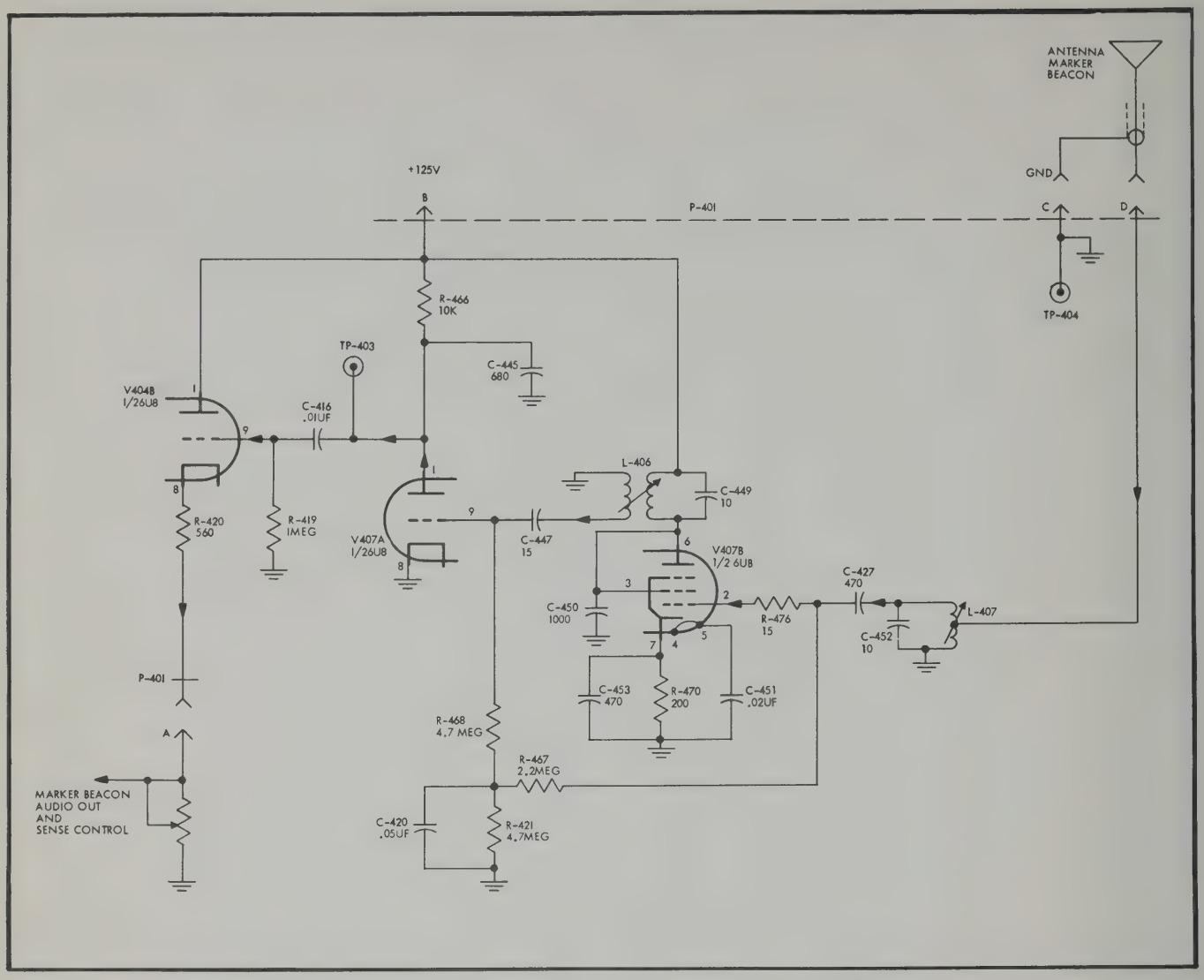


Figure 3-26. Marker Beacon Receiver Schematic Diagram

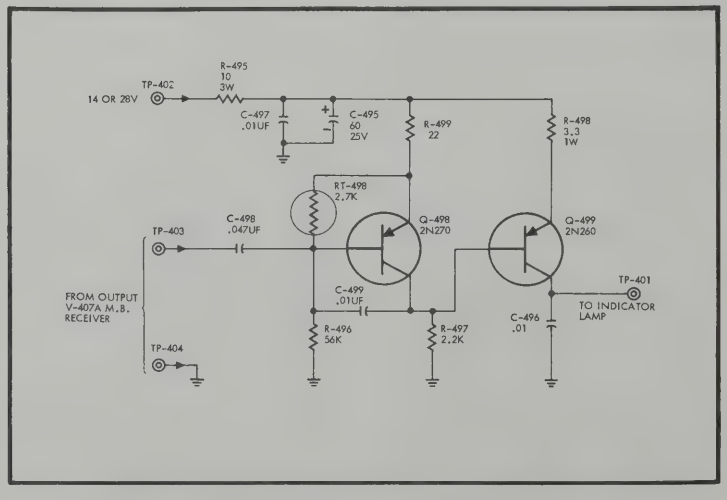


Figure 3-27. Marker Beacon Receiver Indicator Light Amplifier, Schematic Diagram

SECTION IV

MAINTENANCE

4.1 GENERAL

This section contains information pertaining to alignment, testing, and trouble-shooting of the LNC-100 System. Test equipment requirements and a recommended test harness for bench maintenance are also included in this section. Vacuum-tube socket voltage and resistance measurements as well as gain-per-stage data for each of the principal system modules are also included.

4.2 TEST EQUIPMENT

The test equipments or their equivalents required to perform the procedures in this section are listed in the following table.

MANUFACTURER AND PART OR MODEL NO.	NAME OF EQUIPMENT	DESCRIPTION AND USE
Boonton Model 211-A with 6-db 52-ohm pad	R-F Signal Generator	Generate vhf signals for alignment and testing.
Collins Model 479S-3	Audio Signal Generator	Simulates VOR and localizer signals for alignment and testing.
Hewlett-Packard Model 410B	Vacuum Tube Voltmeter	A-C and d-c voltage, and resistance measurements.
Hewlett-Packard Model 400C	Vacuum Tube Voltmeter	Low-level r-f and a-f voltage measurements.
Lambda Model 25	14- or 28-Volt Power Supply (100 ma)	Supply primary d-c power.
Hewlett-Packard Model 200CD	Audio Oscillator	Generates audio signals for testing amplifier-modulator.
Dumont 304A	Oscilloscope	For observing signal waveforms.
Hewlett-Packard 330B	Audio Distortion Meter	For measuring audio distortion.
Bird Model 611	R-F Wattmeter	For measuring transmitter output power.
Hewlett-Packard Models 524B & 525B	Frequency Counter and Converter	For checking transmitter frequency.
General Radio Model 583-A	Output Meter	For measuring audio output power.
	Carbon Microphone with TRANS-RECEIVE button switch 100 ohms nominal	
Must be fabricated	Bench Test Interconnect Cable	Connects system modules for operation and alignment.
Weston	Microammeter. Internal resistance 1000 ohms, range 250-0-250 ua, accuracy 1%	VOR Right-Left Deviation measurements.

MANUFACTURER AND PART OR MODEL NO.	NAME OF EQUIPMENT	DESCRIPTION AND USE
Weston	Microammeter. Internal resistance 150 ohms, range 500-0-500 ua, accuracy 2%	VOR To-From measurements.
Weston	Microammeter. Internal resistance 1000 ohms, range 0 - 1 ma, accuracy 2%	
Hewlett-Packard Model 608	R-F Signal Generator	For alignment and trouble-shooting.
To be Fabricated	Linear Detector (See Fig. 4-7)	For measuring transmitter modulation capability.
To be Fabricated	Audio Coupling Network (See Fig. 4-6)	To couple output of audio generator into amplifier modulator
	52 OHM 6 Feet Long Co-axial Cable	To connect output of transmitter to Dummy Antenna (Bird Wattmeter)

4.3 TEST HARNESS

Figure 714593 in Appendix I is a schematic of the LNC-100 System interconnect cable. The same cable, with minor modifications for the attachment of external test equipment, can be used as a test harness for bench testing the equipment.

4.4 TEST EQUIPMENT CALIBRATION

The system check-out procedure requires the use of the Collins 479S-3 audio signal generator and the Boonton 211-A r-f signal generator for the simulation of VOR and localizer transmissions. To provide standard VOR and localizer signals, without readjusting the equipment when changing from one to the other, it is necessary that the two signal generators be calibrated.

Two modulation levels are involved in this procedure, namely, 30% and 20%. It is essential that the modulation meter reading of the Boonton 211-A signal generator be known for these levels. Thirty percent is full scale on the B scale, and may be depended upon to be accurate. The 20% reading on the B scale may also be considered to be sufficiently accurate.

On the Collins 479S-3 signal generator, signal levels on the CAL position of the FUNCTION SELECTOR switch are variable by means of the screwdriver adjustment located behind the access door on the front panel of the instrument. Once set, these levels remain constant and need be checked only occasionally. For variable output levels in special testing work, the SPECIFIC SIG position of the FUNCTION SELECTOR switch and the MASTER ATTENUATOR control should be used. Use of the MASTER ATTENUATOR control does not disturb the calibration made in the CAL position.

4.5 CALIBRATION OF VOR SIGNALS.

Normal VOR modulation consists of a 30% 9960-cps FM signal and a 30% 30-cps AM signal which is rotatable in phase with respect to the 30-cps signal derived from the 9960-cps FM. These two 30-cps voltages are in phase on a radial emanating from the station on a magnetic north bearing.

4.5.1 Preliminary Steps

a. Select the scale on the PER CENT MODULATION meter of the 211-A signal generator that gives a full-scale reading for 30% modulation.

b. Reduce the MOD LEVEL control of the 211-A to zero or full counter-clockwise to prevent damage to the modulation meter in case of excessive input voltage.

c. Connect cable from MOD OUTPUT jack of the 479S-3 to the input jack of the 211-A.

d. Rotate FUNCTION SELECTOR switch on the 479S-3 to the CAL position.

e. Open potentiometer door on front panel of 479S-3.

f. Make sure that 1000-cps toggle switch on 479S-3 is in the OFF position.

4.5.2 30-CPS VAR Ø Calibration

a. Rotate SPECIFIC SIGNAL SELECTOR switch to position marked 30 CPS VAR Ø.

b. With a screwdriver, adjust the potentiometer marked 30 CPS VAR Ø until the OUTPUT meter reads 1.5 volts.

c. Lock the potentiometer shaft and check the OUTPUT meter to see that the reading has not changed.

d. Adjust the MOD LEVEL control on the 211-A to read full scale or 30% on the PER CENT MODULATION meter. This setting is now fixed and should not require further adjustment.

4.5.3 9960-FM Calibration

a. Rotate SPECIFIC SIGNAL SELECTOR to position marked 9960 FM.

b. Adjust the potentiometer marked 9960 FM until the PER CENT MODULATION meter on the 211-A again reads full scale.

c. Lock the potentiometer shaft and check the PER CENT MODULATION meter to see that the reading has not changed.

d. A normal omni-range signal may now be obtained by rotating the FUNCTION SELECTOR switch to the position marked ODR. However, the 100% scale of the PER CENT MODULATION meter on the 211-A should be selected first.

4.6 CALIBRATION OF LOCALIZER SIGNALS

4.6.1 90-CPS Calibration

a. With the FUNCTION SELECTOR switch in the CAL position, rotate the SPECIFIC SIGNAL SELECTOR to the position marked 90-150 cycles.

b. Rotate the TONE LOCALIZER switch to the position marked CAL 90 CPS.

c. With the scale of the PER CENT MODULATION meter on the 211-A selected to read 30% full-scale, and the MOD LEVEL control set to read 30%, adjust the potentiometer marked 90 CPS until the 211-A signal generator PER CENT MODULATION meter reads 20%.

d. Lock the potentiometer shaft and check the PER CENT MODULATION meter to see that the reading has not changed.

e. Read the 90-cps voltage carefully on the OUTPUT meter as the 150-cps signal must be set to precisely the same value.

4.6.2 150-CPS Calibration

a. Rotate the TONE LOCALIZER switch clockwise to the position marked CAL 150 CPS.

b. Adjust the potentiometer marked 150 CPS until the reading on the OUTPUT meter is exactly equal to that obtained during the 90-cps adjustment (Paragraph 4.6.1e).

CAUTION

This adjustment of the 90- and 150-cps voltages should be made accurately since small unbalances in these voltages will likely result in incorrect calibration of the localizer converter channel of the Model 2374 module.

c. Lock the potentiometer shaft and check to see that the OUTPUT meter reading has not changed.

d. Recheck both the 90- and 150-cps voltages to ensure that the balance condition is still in effect.

e. Correct tone localizer signals may now be obtained by selecting the 100% scale of the PER CENT MODULATION meter of the Boonton 211-A r-f signal generator and rotating the FUNCTION SELECTOR switch on the Collins 479S-3 audio signal generator to the position marked TONE LOC. The TONE LOCALIZER switch may now be rotated to the position desired for accurate checking or calibration of the LNC-100 localizer facility.

NOTE

The 479S-3 OUTPUT meter deflection is proportional to the average value of a wave whereas the PER CENT MODULATION meter of the 211-A deflects in proportion to the peak value of a wave. Use of the 479S-3 meter for balance of the tone localizer voltages is recommended over the peak-reading meter as it is less susceptible to errors due to small harmonics.

4.6.3 1000-CPS Calibration

a. With the FUNCTION SELECTOR switch in the CAL position, rotate the SPECIFIC SIGNAL SELECTOR switch to the position marked 1000 CPS.

b. With the scale of the PER CENT MODULATION meter on the 211-A selected to read 30% full-scale, and the MOD LEVEL control set to read 30%, adjust the potentiometer R-128 marked 1000 CPS until the PER CENT MODULATION meter reads the percentage of modulation desired.

c. Lock the potentiometer shaft and check the PER CENT MODULATION meter on the 211-A to see that the reading has not changed.

d. Select the 100% scale on the PER CENT MODULATION meter of the 211-A.

e. This signal may be superimposed upon any other signal present at the MOD OUTPUT jack by throwing the 1000 CPS toggle switch to the ON position.

CAUTION

A pilot light is provided on the 479S-3 to remind the operator that the 1000-cps signal is present at the MOD OUTPUT jack. Where the 1000-cps signal is not desired, the operator must be aware of the warning service provided by the light.

4.7 OTHER ADJUSTMENTS

Variable level output is obtained by rotating the FUNCTION SELECTOR switch to the position marked SPECIFIC SIG., and selecting the desired signal by rotating the SPECIFIC SIGNAL SELECTOR. The level of each signal except the tone localizer frequencies may be varied from zero to approximately 3 volts by adjusting the MASTER ATTENUATOR control. If the 90- and 150-cps calibration has been completed, each of these frequencies may be varied from zero to approximately 2 volts with the MASTER ATTENUATOR control. If additional 90- or 150-cps voltage is desired, the 90- and 150-CPS potentiometers behind the access door may be turned by unlocking the shafts. However, this will destroy the calibration of the tone localizer facility as normally used in receiver testing, and the function should be re-calibrated before using the modulator for such testing.

When selecting the 1000-cps signal by itself, it is not necessary to throw the 1000 CPS toggle switch to the ON position.

CAUTION

It is possible to overload the 3-volt OUTPUT meter on the Collins 479S-3 when the FUNCTION SELECTOR switch is in the position marked SPECIFIC SIG. This can be done by superimposing the 1000-cps signal on another signal or by calibrating the localizer frequencies at a high voltage and then rotating the TONE LOCALIZER switch to one of the decibel steps. Such occurrences must be kept to a minimum.

4.8 LNC-100 SYSTEM CHECK-OUT PROCEDURE

4.8.1 General

The equipment is completely tested and aligned before shipment from the factory. The tests below reveal the salient performance characteristics of the system and indicate whether or not it is operating within the original specifications. These procedures should be performed whenever it is necessary to check the performance of the system or as a part of routine preventative maintenance.

4.8.2 Equipment Connections

a. Assemble the modules of the LNC-100 System with the interconnect cable as shown in Figure 4-1.

b. Connect the output of the Boonton 211-A r-f signal generator to the antenna input receptacle on the vhf receiver high-pass filter.

c. Connect cable from MOD OUTPUT jack of the 479S-3 to the input jack of the 211-A.

d. Connect the VTVM to terminal H of connector P-401 on the Model 2374 module.

e. Connect the right-left deviation microammeter to pins N and M of connector P-401 on the Model 2374 module. (See Table 4-1.)

f. Connect the to-from microammeter to terminals W and U of connector P-401 on the Model 2374 module. (See Table 4-1.)

g. Connect the flag milliammeter to terminals I and Y of connector P-401 on the Model 2374 module.

NOTE

This check-out procedure assumes that the LNC-100 System is being operated with a single Model 4087A navigation indicator. When other system configurations are employed, reference should be made to the notes on schematic diagram 714593 in Appendix I before connecting the microammeters to the Model 2374 module.

h. Disconnect terminal P from terminals R and M on connector P-401 of the Model 2374 module.

i. Disconnect terminal S from terminal U on connector P-401 of the Model 2374 module.

NOTE

Steps h and i should be reversed when the external microammeters are removed from the Model 2374 module.

j. Connect the output meter to the interconnect cable loudspeaker output lead (Model 2355 module, P-301, terminal J).

4.8.3 VHF Receiver-VOR Converter Check

a. Tune the 211-A r-f signal generator to a VOR channel (108.2 mc), and adjust the generator-output voltage to 5 microvolts. (Ten microvolts with 6-db pad.)

b. Tune the vhf receiver to 108.2 mc.

c. Turn the FUNCTION SELECTOR switch on the 479S-3 audio generator to the ODR position.

d. Re-tune the 211-A signal generator for maximum reading on the VTVM.

e. Increase the output voltage of the 211-A signal generator to 1000 microvolts.

f. The VTVM should read 0.95 volt rms. If the reading is not as required, adjust potentiometer R-243, located on the rear end-plate of the vhf receiver, until the VTVM reads 0.95 volt.

g. Increase output of 211-A signal generator to 10,000 microvolts.

h. Reading on the VTVM should increase to not more than 1.0 volt rms. (This checks the vhf receiver avc.)

i. Reduce the output of the 211-A to 1000 microvolts.

j. Adjust OBS knob on Model 4087A navigation indicator to zero degree.

k. Adjust PHASE ANGLE SELECTOR control on 479S-3 generator to zero degree.

l. The vertical right-left needle in the Model 4087A navigation indicator, and the needle in the paralleled right-left microammeter, should be centered, ±1.2 degrees.

m. The TO-FROM indicator in the Model 4087A navigation indicator should read FROM, and the parallel TO-FROM microammeter should read approximately 125 microamperes (half the normal 250-microampere TO-FROM current).

n. Adjust the PHASE ANGLE SELECTOR on the 479S-3 generator to a bearing of 10 degrees.

o. The right-left deviation microammeter should read at least 90 microamperes.

p. Adjust the PHASE ANGLE SELECTOR on the 479S-3 generator to a bearing of 350 degrees.

q. The right-left deviation microammeter should read at least 90 microamperes in the direction opposite to that of step o. The deflection on one side of the center zero position should be within 10% of that on the other side for the same phase difference.

r. During the above measurements the warning flag in the Model 4087A navigation indicator should be down, and the paralleled flag milliammeter should read between 245 and 260 microamperes.

s. Adjust the PHASE ANGLE SELECTOR on the 479S-3 generator and the OBS on the Model 4087A module in 30-degree steps from 0 to 360 degrees. The accuracy of the converter at all points should be within ±1.2 degrees.

t. Adjust the OBS to zero degree and the PHASE ANGLE SELECTOR to 90 degrees. The TO-FROM indicator should center, and the TO-FROM microammeter should read zero.

u. Adjust the OBS to zero degree and the PHASE ANGLE SELECTOR to 110 degrees. The TO-FROM indicator should read TO and the TO-FROM microammeter should read approximately 125 microamperes.

4.8.4 In the event the readings obtained in the above check procedure (Paragraph 4.8.3) do not fall within the tolerances specified, refer to the vhf receiver and VOR converter alignment procedures in Paragraphs 4.11 and 4.13 respectively.

4.8.5 VHF Receiver-Localizer Converter Check

a. Tune the Boonton 211-A r-f signal generator to a localizer channel (108.10 mc).

b. Tune the vhf receiver to 108.10 mc.

c. Turn the FUNCTION SELECTOR switch on the 479S-3 to the TONE LOC position.

d. Turn the SPECIFIC SIGNAL SELECTOR switch on the 479S-3 to the 90-150 cps position.

e. Turn the TONE LOCALIZER switch on the 479S-3 to the 0 position.

f. Increase the output of the 211-A to 1000 microvolts.

g. The VTVM should read 0.95 volt rms.

h. The right-left needle in the Model 4087A navigation indicator, and the right-left needle in the paralleled microammeter should be centered. Also the localizer flag should be out of sight.

i. Set the TONE LOCALIZER control on the 479S-3 first in the 90-cps sector, and then in the 150-cps sector (4 db position).

j. The right-left microammeter should read 90 ±5 microamperes in both directions.

k. Connect d-c voltmeter to terminal K of connector P-401 on Model 2374 module and measure avc voltage. It should be 3.0 volts ±5%.

4.8.6 In the event the readings obtained in the above procedure (Paragraph 4.8.5.) do not fall within the tolerances specified, refer to the vhf receiver and localizer converter alignment procedures in Paragraphs 4.11 and 4.14.

4.8.7 VHF Receiver and Audio Amplifier Check

a. Adjust the 211-A generator to 120.5 mc, and the vhf receiver to the same frequency.

b. Turn FUNCTION SELECTOR switch on the 479S-3 to the SPECIFIC SIG. position, and the SPECIFIC SIGNAL SELECTOR switch to the 1000 CPS position.

c. Adjust output of the 211-A signal generator to 10 microvolts.

d. The output meter should read at least 5 watts into 3.2 ohms.

4.8.8 If the output power is below the rated output as specified in step 4.8.7d, reference should be made to the vhf receiver alignment procedure in Paragraph 4.11.

4.8.9 75-MC Marker Beacon Receiver Check

a. Connect the output of the 211-A r-f signal generator to the marker-beacon antenna input lead of the interconnect cable (from terminal D, P-401, Model 2374 module).

b. Adjust the signal generator to 75 mc ±0.01%, modulated 95% at 400 cps, 2000 microvolts output.

c. The audio output, measured with a VTVM at pin A of connector P-401, Model 2374 module, should be 0.8 volt minimum.

d. Increase the modulation frequency to 1300 cps and then to 3000 cps.

e. The reading on the VTVM should be 0.8 volt minimum.

4.9 VHF TRANSMITTER CHECK

a. Connect the Bird 611 r-f wattmeter through a 52-ohm co-axial cable (6-ft length) to the antenna output connector J-102 of the vhf transmitter.

b. Ground the TRANSMIT-RECEIVE lead of the interconnect cable by depressing the microphone button switch.

c. The r-f wattmeter should read a minimum of 3 watts.

d. Connect the Collins 479S-3 audio signal generator to the microphone input jack of the interconnect cable through the audio coupling circuit.

e. Tune the audio signal generator to 1000 cps and adjust the output voltage to a level sufficient to observe modulation flicker on the Bird 611 wattmeter.

4.10 ALIGNMENT AND MINIMUM PERFORMANCE TESTS

Paragraph 4.8 outlines a system check-out procedure for rapidly determining whether or not the LNC-100 System is operating satisfactorily. These test procedures are largely "qualitative" in nature and are based on the assumption that each module (or section thereof) of the system is aligned for optimum performance. During the course of the system check-out procedure, marginal or faulty performance may be encountered. Marginal performance could indicate that one or more of the system modules is out of alignment, while faulty performance indicates that one or more of the system modules are malfunctioning. Paragraphs 4.11 through 4.15 outline detailed procedures for the alignment and minimum performance testing of each of the system modules. Paragraphs 4.16 through 4.26 outline detailed trouble-shooting procedures for each of the system modules.

4.11 VHF RECEIVER ALIGNMENT PROCEDURE

4.11.1 General*

VHF receiver alignment procedures should be performed under the following conditions:

a. For 14-volt operation the primary voltage should be 13.75 volts ±3% nominal; 15 volts high and 11 volts low.

b. For 28-volt operation the primary supply voltage should be 27.50 volts ±3% nominal; 30 volts high and 22 volts low.

c. The B-plus voltage should be 132 volts ±3% nominal; 139 volts high, 125 volts low.

d. A 6-db 52-ohm attenuator should be connected between the Boonton 211-A r-f signal generator output and the receiver input to properly match the generator-output impedance.

e. Allow a 2-minute warm-up period.

f. Wherever called for, a standard input signal is a carrier of specified frequency, and amplitude-modulated by 1000 cps at 30%.

*4.11.2 Alignment of R-F Amplifier, 1st Mixer, and Megacycle Oscillator

a. Connect the output of the 211-A signal generator to the antenna input of the receiver and adjust for a standard input signal of 108.5 mc at 200,000 uv.

b. Connect the input of the VTVM through a 10-k isolating resistor to pin 2 of 1st mixer V-202A.

c. Adjust the cores of L-201 and L-204 for a maximum-voltage indication on the 1-volt scale of the VTVM. Reduce the output of the signal generator as the voltage on the VTVM increases with alignment.

d. Tune the receiver to 108.0 and 108.9 mc and observe the voltmeter reading. It should be not more than 3 db down from the reading obtained at 108.5 mc.

e. Set signal generator to 130.5 mc, and tune the receiver to the same frequency.

f. The VTVM reading on this channel should be at a maximum and approximately 6 db less than at 108.5 mc for the same microvolt setting of the signal generator.

g. Repeat steps a through f until no further improvement can be obtained, and then check the alignment in the center of the frequency range by tuning the 211-A signal generator and the receiver to 120.5 mc.

*4.11.3 Variable I-F Amplifier, 2nd Mixer, and Tenth-Megacycle Oscillator

a. Readjust the signal generator and the receiver to 108.5 mc. Connect the VTVM to pin 2 of 2nd mixer V-204A through a 10-k isolating resistor.

b. Adjust the cores of coils L-205, L-206, and interstage transformer T-201 for a maximum reading on the 1-volt scale. Reduce the signal generator output voltage to keep the voltage reading on the VTVM within the 1-volt scale.

c. Tune the signal generator to 108.00, 108.50, and 108.90 mc in succession and note readings on the VTVM. The voltage readings should be within 2 db of one another.

*4.11.4 Fixed I-F Amplifier

a. Connect the VTVM to pin 9 of 2nd detector V-206.

*See addendum No. 7 for revised alignment procedure

b. Tune the signal generator to 108.50 mc.

c. Adjust the cores of both primary and secondary of transformers T-202, T-203, and T-204 for maximum reading on the VTVM. Reduce signal generator output to maintain VTVM voltage reading on the 1-volt scale.

d. The receiver is now ready for minimum performance standard measurements.

4.12 MINIMUM PERFORMANCE MEASUREMENTS: VHF RECEIVER

4.12.1 Overall Gain

a. Connect the VTVM through a 0.1-mfd capacitor to pin 8 of navigation amplifier V-205B.

b. Adjust the Boonton 211-A r-f signal generator output to 5 microvolts modulated 30% at 1000 cps, and check the gain at the following frequencies:

108.00 mc	108.50 mc	108.90 mc
115.00 mc	115.50 mc	115.90 mc
126.00 mc	126.50 mc	126.90 mc
130.00 mc	130.50 mc	130.90 mc

c. The VTVM should read at least 1-volt rms output at all frequencies.

4.12.2 Signal-Plus-Noise to Noise Ratio

a. Adjust the 211-A signal generator output voltage to 5 microvolts at 108.50 mc, modulated 30% at 1000 cps.

b. Connect the VTVM through a 0.1-mfd capacitor to pin 8 of navigation amplifier V-205B, and measure the output voltage.

c. Remove the modulation from the signal generator signal and note the reading on the VTVM.

d. The VTVM should read at least 6 db down when the modulation is removed.

4.12.3 Overall Selectivity

a. Adjust the 211-A signal generator output voltage to 10 microvolts at 108.50 mc modulated 30% at 1000 cps.

b. Adjust the output of the signal generator to 10 microvolts and note the reading on the VTVM when the receiver is tuned to 108.50 mc.

c. Increase the output of the signal generator to 20 microvolts and de-tune the signal generator either side of the center-frequency until the VTVM gives the same reading as in step b.

d. The bandwidth of the 6-db points should be a minimum of 35 kc.

e. Increase the output of the signal generator to 10,000 microvolts, and de-tune the signal generator until the VTVM gives the same reading as in step b.

f. The bandwidth of the 60-db points should be a maximum of 148 kc.

4.12.4 AVC Characteristic

a. Adjust the 211-A signal-generator output voltage to 10 microvolts modulated 30% at 1000 cps, and tune the receiver to the same frequency.

b. Note the reading on the VTVM connected to pin 3 of connector P-203 on the vhf receiver.

c. Increase the signal generator voltage to 20,000 microvolts, and again note the reading on the VTVM.

d. The VTVM reading should not increase more than 10 db between the two signal input levels.

4.12.5 Audio Frequency Response

a. Adjust the 211-A r-f signal generator to 100 microvolts at 108.5 mc modulated 30% at 1000 cps.

b. Adjust the receiver volume control until the General Radio Model 583-A output meter reads 2.5 watts into 3.2 ohms (half rated output).

c. Holding the signal level and the modulation percentage constant, vary the modulation frequency in the following increments: 100, 200, 350, 500, 700, 1000, 1500, 2000, 3000, and 4000 cps.

d. Between 300 and 3000 cps the audio output should not vary more than 6 db.

e. There should be a pronounced roll-off below 200 cps and above 3000 cps.

4.13 VOR CONVERTER ALIGNMENT

4.13.1 General

Alignment procedures can be performed on the VOR converter alone, or on the converter and the vhf receiver in combination, providing that the receiver has already been aligned as described in Paragraph 4.11. The only difference between the two procedures is that in the former case (VOR converter alone) the output of the Collins 479S-3 audio signal generator is applied directly to the input (terminal H, P-401, Model 2374 module) of the VOR converter, whereas in the latter case (VOR converter and vhf receiver in combination), the output of the 479S-3 is used to modulate the Boonton 211-A r-f signal generator, the output of which is in turn applied to the vhf receiver. The alignment procedure outlined below is for the VOR converter and the vhf receiver in combination.

4.13.2 Preliminary Procedure

a. Assemble the system components as shown in Figure 4.1.

b. If the test equipment has not been calibrated, proceed with the calibration as described in Paragraph 4.4. The test equipment should be calibrated each time it is used and the modulation levels checked frequently during alignment.

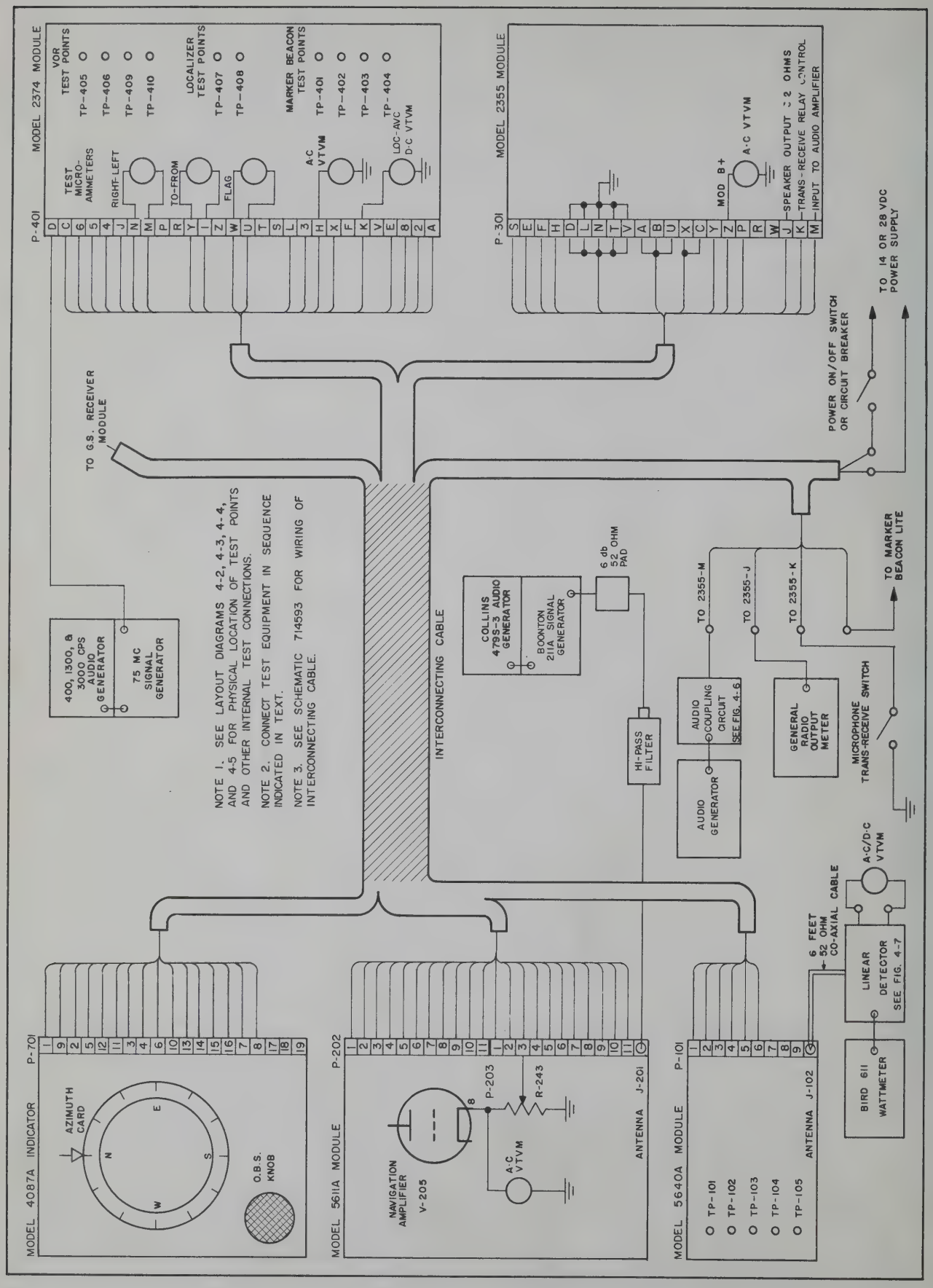


Figure 4-1. LNC-100 Bench Test Layout

c. Turn on the system and all test equipment and allow ten minutes for warm-up before proceeding with alignment.

d. Check the voltage of the power source. Maintain the voltage at 13.75 vdc ±2% throughout the alignment procedure unless otherwise specified. With 28-volt installations the primary source should be maintained at 27.5 vdc ±2%.

e. Connect the output of the Boonton 211-A r-f signal generator through a 6-db 52-ohm pad to the antenna input receptacle of the vhf receiver high-pass filter.

f. Connect the A-C VTVM to terminal H of connector P-401 on the Model 2374 module.

g. Tune the 211-A to 114.9 mc by turning the OSC SEL switch to the XTAL position and the XTAL switch to the 114.9 mc position. Adjust to 1000 microvolts with the RF LEVEL control.

h. Turn the FUNCTION SELECTOR switch on the Collins 479S-3 to the ODR position.

i. The composite VOR signal input to the Model 2374 module should be 0.95 volt rms as measured by the VTVM connected to pin H of P-401. (If the reading is not as required, adjust potentiometer R-243 on the rear end-plate of the Model 5611A vhf receiver until the VTVM reads 0.95 volts rms.)

j. Connect the right-left, to-from, and flag-alarm microammeters as outlined in steps e through i of Paragraph 4.8.2.

k. Connect the vertical input of the oscilloscope to test point TP-405 on the Model 2374 module (see Figure 4-3 for location of TP-405) and adjust the scope for internal sweep.

l. Tune coil L-401 for maximum unclipped waveform on the scope. (Tuned circuit L-401 and C-414 introduces a 30-cps amplitude-modulation on the 9960-cps sub-carrier.)

m. Connect the scope to TP-406 on the Model 2374 module and tune coil L-402 for maximum unclipped waveform. (The tuning point should be at about half-travel of the core.)

4.13.3 VOR Zero Adjustment

a. Set the PHASE ANGLE SELECTOR control on the 479S-3, and the OBS knob on the Model 4087A navigation indicator to zero degree.

b. Set centering potentiometer R-455 in the Model 2374 module to approximately the center position.

c. Center the right-left deviation needle in the Model 4087A indicator by adjusting phase-shift potentiometer R-432 in the Model 2374 module.

d. Turn the OBS dial to 180 degrees. If the right-left deviation needle does not center, correct by adjusting for half of the deviation with R-455, and the other half of the deviation with R-432.

e. Repeat steps a through d as often as required to obtain minimum deviation of right-left needle at 0 and 180 degrees.

f. Adjust PHASE ANGLE SELECTOR on the 479S-3, and OBS dial to a bearing of 90 degrees, and observe right-left deviation needle in the Model 4087A indicator.

g. If needle is off-center, replace fixed resistor R-444 with one having the value required to obtain centering.

h. Repeat steps a through g until the minimum error is obtained. The maximum tracking error between the PHASE ANGLE SELECTOR reading and the OBS dial reading should not exceed 1.2 degrees at any position of the OBS dial.

4.13.4 VOR Deviation Indicator Sensitivity Test

a. Complete procedures under Paragraph 4.13.2 above.

b. Turn the FUNCTION SELECTOR switch on the Collins 479S-3 to the ODR position and the PHASE ANGLE SELECTOR control to a course setting of 10 degrees.

c. Adjust the OBS dial on the Model 4087A indicator to zero degree.

d. The right-left microammeter should read at least 90 microamperes.

e. Turn the PHASE ANGLE SELECTOR control on the 479S-3 to a course setting of 350 degrees.

f. The right-left microammeter should read at least 90 microamperes.

g. The difference between the two readings, d and f, should be less than 10%.

4.13.5 VOR To-From Indicator Test

a. Complete procedures under Paragraph 4.13.2 above.

b. Turn the FUNCTION SELECTOR switch on the Collins 479S-3 to ODR, and the PHASE ANGLE SELECTOR to zero degree.

c. Turn the OBS knob on the Model 4087A indicator to zero degree.

d. The TO-FROM indicator in the Model 4087A indicator should read FROM, and the microammeter should read 125 microamperes. (This represents a to-from current of 250 microamperes as the microammeter is connected in parallel with the TO-FROM indicator d-c meter movement.)

e. Turn the OBS knob to 90 degrees. The TO-FROM indicator should center and the to-from microammeter should read zero microampere.

f. Turn the OBS knob to 180 degrees. The TO-FROM indicator should read TO, and the to-from microammeter should read 125 (220) microamperes (approximately).

4.13.6 VOR Flag Test

a. Complete procedures under paragraph 4.13.2 above.

b. Turn the FUNCTION SELECTOR switch on the 479S-3 to ODR, and the PHASE ANGLE SELECTOR control to zero degree.

c. Turn the OBS knob on the Model 4087A indicator to zero degree.

d. Reduce the output voltage of the Boonton 211-A r-f signal generator from 1000 microvolts until the VTVM (connected to pin H, connector P-401, Model 2374 module) reduces from 0.95 volt rms to 0.7 volt rms.

e. Under these conditions the FLAG should be down and the flag microammeter should read between 245 and 260 microamperes.

f. If the flag microammeter does not read as required in step e replace fixed resistor R-452 with one of the correct value to produce the required reading.

4.13.7 VOR Stability Tests under Varying Conditions.

a. Variation of R-F Signal Level

(1) Complete procedures under Paragraph 4.13.2

(2) Turn the FUNCTION SELECTOR switch on the Collins 479S-3 to ODR.

(3) Adjust the output of the Boonton 211-A to obtain a reading on the VTVM (connected to pin H, P-401, Model 2374 module of 0.95 volt rms.

(4) Set the OBS dial on the Model 4087A indicator to zero degree.

(5) Adjust the PHASE ANGLE SELECTOR control for exact zeroing of the right-left microammeter. The TO-FROM indicator should read FROM.

(6) Record the OBS dial reading (zero degree) and DO NOT CHANGE THE PHASE ANGLE CONTROL SETTING for the remainder of this procedure.

(7) Increase the output of the Boonton 211-A until the VTVM reads 1.1 volts, and recenter the right-left microammeter by adjusting the OBS knob. Record the reading of the OBS dial.

(8) Decrease the output of the Boonton 211-A until the VTVM reads 0.65 volt rms, and recenter the right-left microammeter by adjusting the OBS knob. Record the reading of the OBS dial.

(9) The recorded OBS settings should not vary more than 1 degree when the input voltage to the VOR converter is varied from 0.65 to 1.1 volts rms as read on the VTVM.

b. Variation of Modulation Level

(1) Complete procedures under Paragraph 4.13.2 above.

(2) Turn the FUNCTION SELECTOR switch on the Collins 479S-3 to ODR.

(3) Adjust the output of the Boonton 211-A to obtain a reading on the VTVM of 0.95 volt rms.

(4) Set the OBS dial on the Model 4087A indicator to zero degree.

(5) Adjust the PHASE ANGLE SELECTOR control for exact zeroing of the right-left microammeter. The TO-FROM indicator should read FROM. DO NOT CHANGE THIS SETTING.

(6) Record the reading of the OBS dial (zero degree).

(7) Increase the modulation percentage (on the Boonton 211-A) to 35%, and recenter the right-left microammeter by adjusting the OBS knob. Record the reading of the OBS dial.

(8) Decrease the modulation percentage (on the Boonton 211-A) to 25% and recenter the right-left microammeter by adjusting the OBS knob. Record the reading of the OBS dial.

(9) The bearing indications of the OBS dial should not vary more than ±0.5 degree when the modulation level is varied from 25% to 35%.

c. Variation of Line Voltage

(1) Complete procedures under Paragraph 4.13.2 above.

(2) Repeat steps (2) through (6) in Paragraph 4.13.7b above.

(3) Increase the primary supply voltage (13.75 or 27.50 vdc) by 10%, and wait one minute.

(4) Recenter the right-left microammeter by adjusting the OBS knob, and record the reading of the OBS dial.

(5) Decrease the primary supply voltage (13.75 or 27.50 vdc) by 10% and wait one minute.

(6) Recenter the right-left microammeter by adjusting the OBS knob, and record the reading of the OBS dial.

(7) Return the d-c power supply to the nominal value.

(8) The bearing indications of the OBS dial should not vary more than ±0.5 degree as the primary d-c voltage is varied above and below its nominal value by 10%.

4.14 LOCALIZER CONVERTER ADJUSTMENT

4.14.1 General

The alignment procedures outlined below are for the vhf receiver and the localizer converter in combination. The same adjustments can be made on the localizer converter singly by applying the output of the Collins 479S-3 audio signal generator directly to the input of the localizer converter.

14.14.2 Preliminary Procedures

a. Repeat steps a through f of Paragraph 4.13.2.

b. Tune the Boonton 211-A r-f signal generator to 110.1 mc and an output of 1000 microvolts (0.95 volt rms).

c. Turn the FUNCTION SELECTOR switch to the position marked TONE LOC, and the PER CENT MODULATION meter on the Boonton 211-A to the 100% scale.

d. Set the TONE LOCALIZER db-ratio control to the zero position.

4.14.3 Localizer Zero Adjustment

a. Adjust centering potentiometer R-428 in the localizer converter to center the right-left needle in the Model 4087A navigation indicator, and the right-left needle in the right-left microammeter.

b. If the needles will not center, return R-428 to approximately center position, and select values of fixed resistor R-425 or capacitor C-454 that will permit potentiometer R-428 to center the needles. (C-454 should be 0.01 or 0.02 mfd.)

c. Set the TONE LOCALIZER db-ratio control to the right 4-db position. The deviation-indicator needle should move to the yellow sector, and the deviation current should be 90 ±5 microamperes.

d. Set the TONE LOCALIZER db-ratio control to the left 4-db position. The deviation-indicator needle should move to the blue sector, and the deviation current should be 90 ±5 microamperes.

e. Connect a d-c VTVM to pin K of connector P-401 on the Model 2374 module to measure the avc voltage. It should be 3.0 volts ±5% for the current values indicated in steps c and d.

f. If the deviation current is not 90 ±5 microamperes for the 4-db positions of the TONE LOCALIZER control on either side of zero, select fixed resistor R-474 to obtain this value. The avc voltage (measured at pin K of connector P-401 on the Model 2374 module), should be 3 volts ±5% for the deviation currents specified.

4.15 75-MC MARKER BEACON RECEIVER ALIGNMENT

4.15.1 Preliminary Procedure

a. Connect output of r-f signal generator (Hewlett Packard Type 608) to the antenna input terminal (pin D, connector P-401) of the marker-beacon receiver section of the Model 2374 module.

b. Connect the VTVM to TP-403 on the marker-beacon receiver. (See Figure 4.3 for location of TP-403.)

4.15.2 Marker-Beacon Receiver Alignment (Light Assembly Not Connected)

a. Set r-f signal generator for 75 mc ±0.10%, modulated 95% at 400 cps, and adjust for 2250 microvolts output.

b. Tune coils L-407 and L-406 in the marker-beacon receiver for maximum response on the VTVM.

c. The VTVM should read a minimum of 0.8 volt rms output with 2250 microvolts input. (Light assembly not connected.)

d. Repeat steps a through c at modulation frequencies of 1300 and 3000 cps.

4.16 VHF TRANSMITTER ALIGNMENT

4.16.1 Preliminary Procedure

a. With the equipment assembled as shown in Figure 4-1, connect Bird Model 611 wattmeter through a 52-ohm co-axial cable (6 feet in length) to the antenna output terminal, J-102, of the Model 5640A module.

b. Remove perforated cover from transmitter.

c. Connect primary power and maintain supply voltage at 13.75 vdc ±2% for 14-volt operation, and 27.5 vdc ±2% for 28-volt operation.

4.16.2 Alignment Procedure

a. Allow two minutes for the equipment to warm up and then close the TRANSMIT-RECEIVE switch.

b. Tune the transmitter to 131.9 mc, and connect the VTVM to TP-101.

c. Adjust the 0.05-mc oscillator tuning core (L-105) for a maximum reading on the VTVM at TP-101. Then increase the inductance by turning the core further into the coil until the VTVM reads 75% of maximum. Lock the core in place.

d. Connect the VTVM to TP-102.

e. Adjust the 1.0-mc oscillator tuning core (L-103) for a maximum reading on the VTVM, and then lock the core in place.

f. Connect the VTVM to TP-103 and check the voltage reading at the following frequencies:

118. 00	118. 50	118. 90
124. 00	124. 50	124. 90
131. 00	131. 50	131. 90

The reading at any setting should be not less than -2. 0 volts.

g. Tune transmitter to 131. 50 mc and connect the VTVM to TP-104.

h. Adjust driver grid tuning core T-101 for maximum reading on the VTVM.

i. Connect the VTVM to TP-105.

j. Adjust power amplifier grid tuning core L-109 for maximum reading on the VTVM.

k. Adjust power amplifier plate tuning core L-113 for maximum reading on the output wattmeter.

l. Tune transmitter to 118. 50 mc, and connect the VTVM to TP-104.

m. Adjust driver grid tuning capacitor C-112 for maximum reading on the VTVM.

n. Connect the VTVM to TP-105.

o. Adjust power amplifier grid tuning capacitor C-122 for maximum reading on the VTVM.

p. Adjust power amplifier plate tuning capacitor C-134 for maximum reading on the output wattmeter.

q. Repeat steps g through p.

r. Check tracking of the tuning mechanism through the complete range of 118. 50 to 131. 50 mc by observing the power output on the wattmeter for all positions of the megacycle control knob. Output power at any frequency should be not less than 3 watts after alignment.

s. Lock all cores and replace cover on transmitter.

4. 16. 3 Transmitter Modulation Capability Test

a. With the equipment assembled as shown in Figure 4-1, connect the output of the audio generator (Hewlett Packard Type 200 or equivalent) through the audio coupling circuit to microphone input terminal M of connector P-301 on the Model 2355 module. (See Figure 4. 6 for details of the microphone circuit.)

b. Connect a linear detector across the 52-ohm coaxial cable connected between the vhf transmitter output and the Bird 611 wattmeter. (See Figure 4-7 for details of the linear detector circuit.)

c. With the transmitter aligned as directed in Paragraph 4. 15. 2, tune the audio generator to 1000 cps and adjust the output voltage to . 9 volt rms.

d. Connect A-C VTVM to pin Z and measure MOD B+. The VTVM should read 170 volts.

e. Connect peak response A-C VTVM across the audio output terminals of the linear detector and record the a-c voltage.

f. Connect the d-c voltmeter across the audio output terminals of the linear detector and record d-c voltage.

g. Calculate the percentage modulation of the vhf transmitter, using the formula:

$$\text{PER CENT MODULATION} = \frac{\text{Peak A-C Volts}}{\text{D-C Volts}} \times 100.$$

h. The modulation capability should be at least 85%.

4. 17 TROUBLE-SHOOTING

4. 17. 1 General

In order to locate trouble in the shortest possible time a logical testing routine should be followed. In the event that faulty operation of the system is encountered, it is first necessary to isolate the particular module, or major module section (i. e. VOR converter, localizer converter, etc.) that is causing the trouble. When the malfunctioning module is isolated, similar methods should be used to localize the fault to a major section of that module, i. e. the r-f, i-f, or audio sections of the vhf receiver. Finally, after isolating the malfunction to a particular section of the module, further isolate it to the faulty stage of that section by making stage-gain, and tube-socket voltage and resistance measurements. The trouble-localization charts and procedures in this section are organized on this basis.

4. 17. 2 Trouble-Localization Charts

Two categories of trouble-localization charts are utilized. The first is on the system level, and the second is on the module level. Depending on the system facility in use, i. e. transmitting or receiving, VOR or Localizer reception, certain modules of the LNC-100 System are common to one or more others. Thus by changing the facility and observing the results, trouble can very often be localized to a particular module without the assistance of any external test equipment. For example, the audio-amplifier section of the Model 2355 module is common to both the vhf and marker-beacon receivers, and as a modulator, to the vhf transmitter. If the unit operates correctly with, say, the vhf receiver and the vhf transmitter, but not with the marker-beacon receiver, the implication is that the marker-beacon receiver is malfunctioning and not the audio amplifier. System Trouble-Shooting Table 4-3 is based on this approach.

The second category of trouble-localization chart is on the module or module section level, and is designed to assist the user to isolate a faulty stage or component within a particular module or module section. By combined use of the trouble-localization

tables and the system check-out procedure outlined in Paragraph 4.8, difficulties in trouble shooting the LNC-100 are reduced to a minimum. Further isolation of the fault within a module can be accomplished by using the appropriate stage-gain tables, and the tube-socket voltage and resistance charts.

4.17.3 Bench Testing the System

Unless the malfunction report clearly indicates that the trouble is in a single module, it is strongly recommended that the LNC-100 System be tested as a whole. Even when the malfunction report does indicate that a particular module is malfunctioning, the report should, if possible, be verified and evaluated by connecting the suspected module into a complete system assembly. The system test harness is illustrated in Figure 4-1 and detailed in Interconnect Schematic 714593 in Appendix I. The system check-out procedure is outlined in Paragraph 4.8.

4.18 MAINTENANCE PROCEDURES

4.18.1 Etched Circuit Servicing Technique

a. General

Etched or printed circuit boards are sheets of insulating material to which a thin sheet of copper is bonded. During manufacture, a photographic process is used to desensitize definite areas of this copper sheet. The insulating board is then dipped into an acid bath which causes the sensitized portions of the copper sheet to be eaten away by the acid solution, leaving only the desensitized portion. The remaining copper then forms a pattern that becomes the conductors for the various circuits included on the board, eliminating the need for bulky wiring. Afterward, holes are drilled through the copper pattern so that leads of components can be passed through them and soldered to the etched side of the board. With the board completely wired, it appears as a number of various components, such as resistors, capacitors, tube sockets, etc., all inter-connected by ribbon-like conductors.

The etched circuit conductors are fragile and special care must be exercised in removing or replacing components. To avoid disturbing the thin copper conductors, a recommended procedure for servicing is given below.

b. Component Removal

(1) Cut the component lead to be removed as close as possible to the component.

(2) Using a small soldering iron (not greater than 35 watts), apply heat to the etched circuit side of the board where the cut component lead protrudes through its access hole.

(3) As the solder on the etched circuit side of the board melts, gently push the component lead through the hole from the opposite side of the board (component side).

(4) When the crimp in the component lead is free of the etched circuit, remove the soldering iron and cut off the lead close to the hole.

(5) Now apply heat to the remaining portion of the wire in the component lead hole and pull the wire through the hole from the component side. (Pulling the wire through from the component side of the etched circuit board will prevent the copper ribbon from being lifted off the board.)

(6) Clean the solder and burrs from the hole. Clear the hole with an awl, if necessary, taking care to clean the hole from the etched side of the board to prevent lifting the copper ribbon.

(7) If the other end of the component is also on the etched circuit board, free its lead in the same manner as outlined in steps (1) through (6) above.

c. Component Replacement

(1) Bend the leads of the component to be mounted on the etched circuit board in such a manner that they pass easily through the holes intended for them. (If a lead is forced through a hole, the etched ribbon may be lifted from the circuit board.)

(2) Using a small soldering iron, solder the lead to the etched circuit board on the etched side of the board by applying heat to the component lead; solder will flow from the lead to the etched circuit board and adhere to the copper ribbon. Care must be exercised so that the copper ribbon is not overheated.

(3) Clip off the excess lead close to the copper ribbon.

(4) Using a small brush dipped in alcohol, remove the solder flux around the lead and the immediate area.

(5) Brush or spray a light film of clear lacquer over the new joint and the surrounding area.

(6) If the component lead continues to another terminal, follow steps 1 and 2 above, but do not clip the lead. Just form the lead to reach the next terminal and solder as required.

d. Repairing Copper Ribbon

If the copper ribbon should inadvertently become broken, or lifted from the etched circuit board, proceed as outlined below:

(1) Pull the loose or broken copper ribbon back so that, when cut, the remaining portions are firmly stuck to the etched circuit board on either side of the break.

TABLE 4-1. SYSTEM TROUBLE LOCALIZATION CHART

APPLIED SIGNAL	OBSERVED SYMPTOM	MALFUNCTIONING MODULE
1. VHF (Communication)	Speaker dead.	Model 2355 Module. Power Supply Section.
VOR (Omni-Range)	No right-left or to-from indication in Navigation Indicator. Flag show OFF.	
LOC (Localizer)	No right-left indication in navigation indicator. Flag shows OFF.	
M. B. (Marker Beacon)	Speaker dead.	
2. VHF	Speaker has sound.	
VOR	As in (1) above.	Model 2374 module. VOR and LOC converter section.
LOC	As in (1) above.	Model 5611A module. Navigating Amplifier stage. (Check for voltage at pin H, P-401, 2374 module to determine which one.)
3. VOR	Right-left, to-from, and flag operate.	Model 2374 module. LOC converter section.
LOC	As in (1) above.	
4. VHF	As in (1) above.	Model 5611A module.
VOR	As in (1) above.	
LOC	As in (1) above.	
M. B.	Speaker has sound.	
5. VOR	As in (1) above.	Model 2374 module. VOR converter section.
LOC	Right-left pointer and flag operate.	
6. VHF VOR	Speaker has sound right-left, to-from, and flag operate.	Model 2374 module. Marker Beacon receiver section.
LOC	Right-left and flag alarm operate.	
M. B.	Speaker dead.	
7. VHF	Speaker dead.	Model 2355 module. Audio amplifier section.
VOR	Right-left, to-from, and flag operate.	
LOC	Right-left and flag operate.	
M. B.	Speaker dead.	

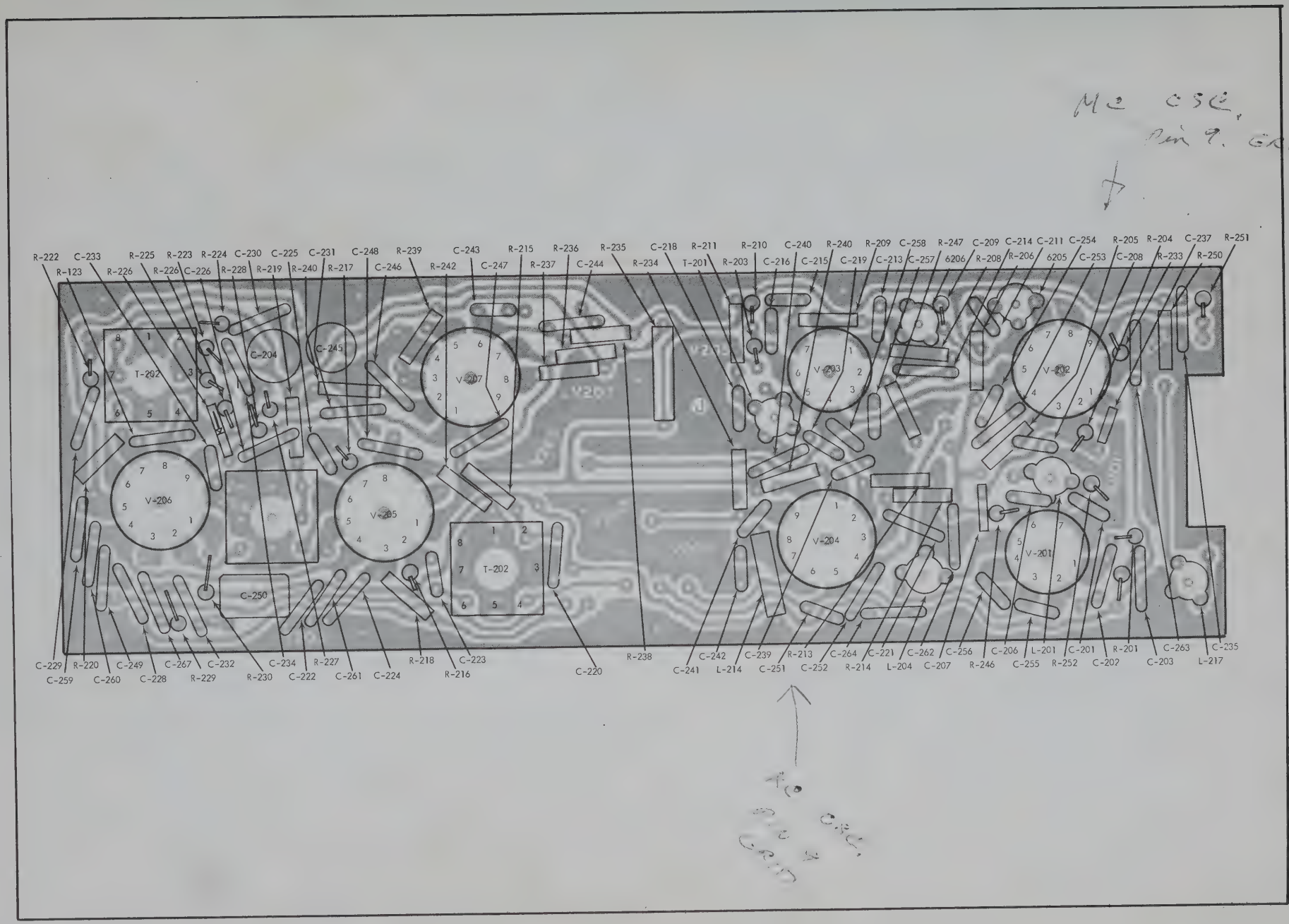


Figure 4-2. Etched Circuit Board Layout Diagram of 5611A VHF Receiver (As Seen from Bottom of Module)

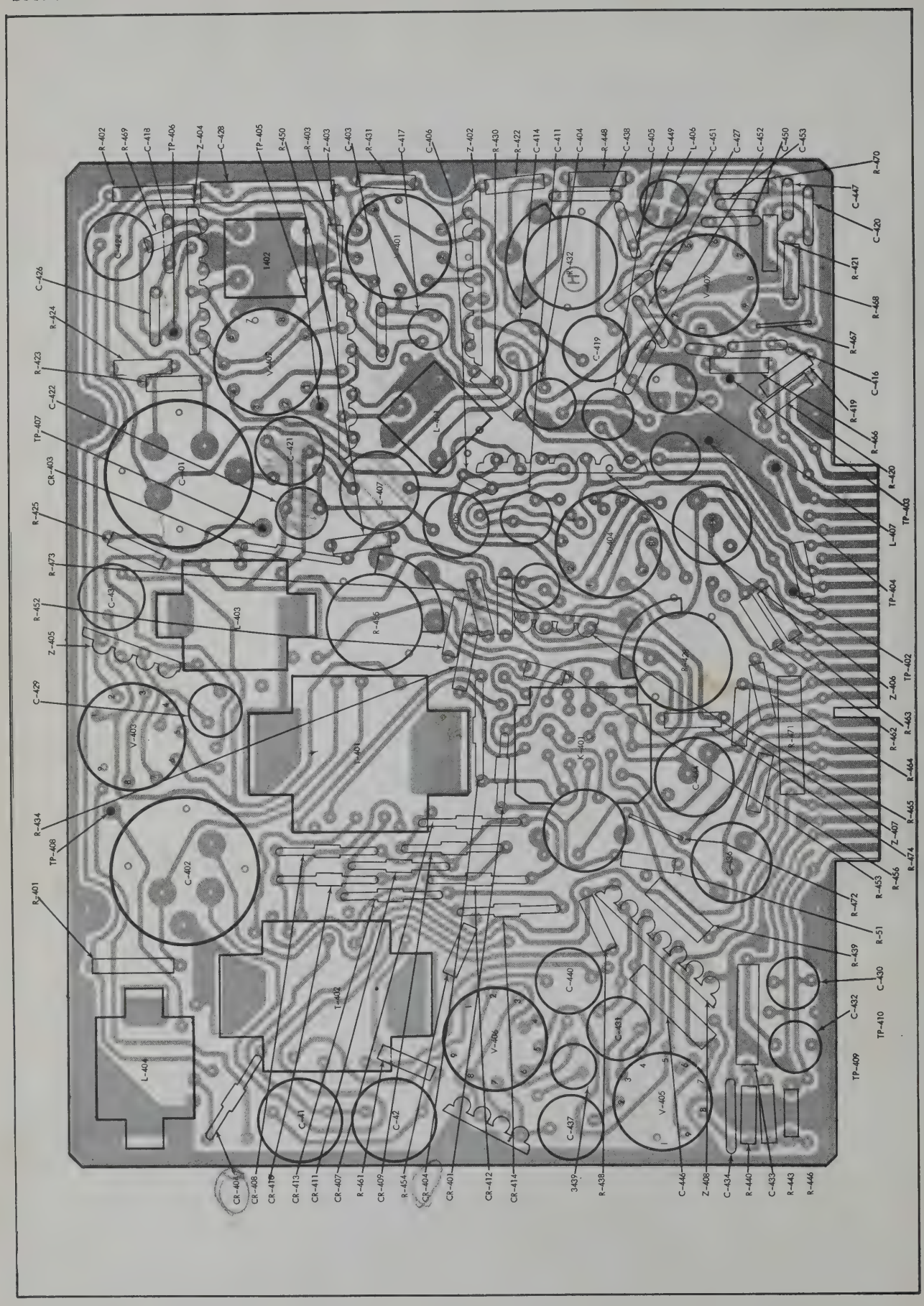


Figure 4-3. Etched Circuit Board Diagram of 2374 VOR-LOC Converter, Marker Beacon Receiver (As Seen from Bottom of Module)

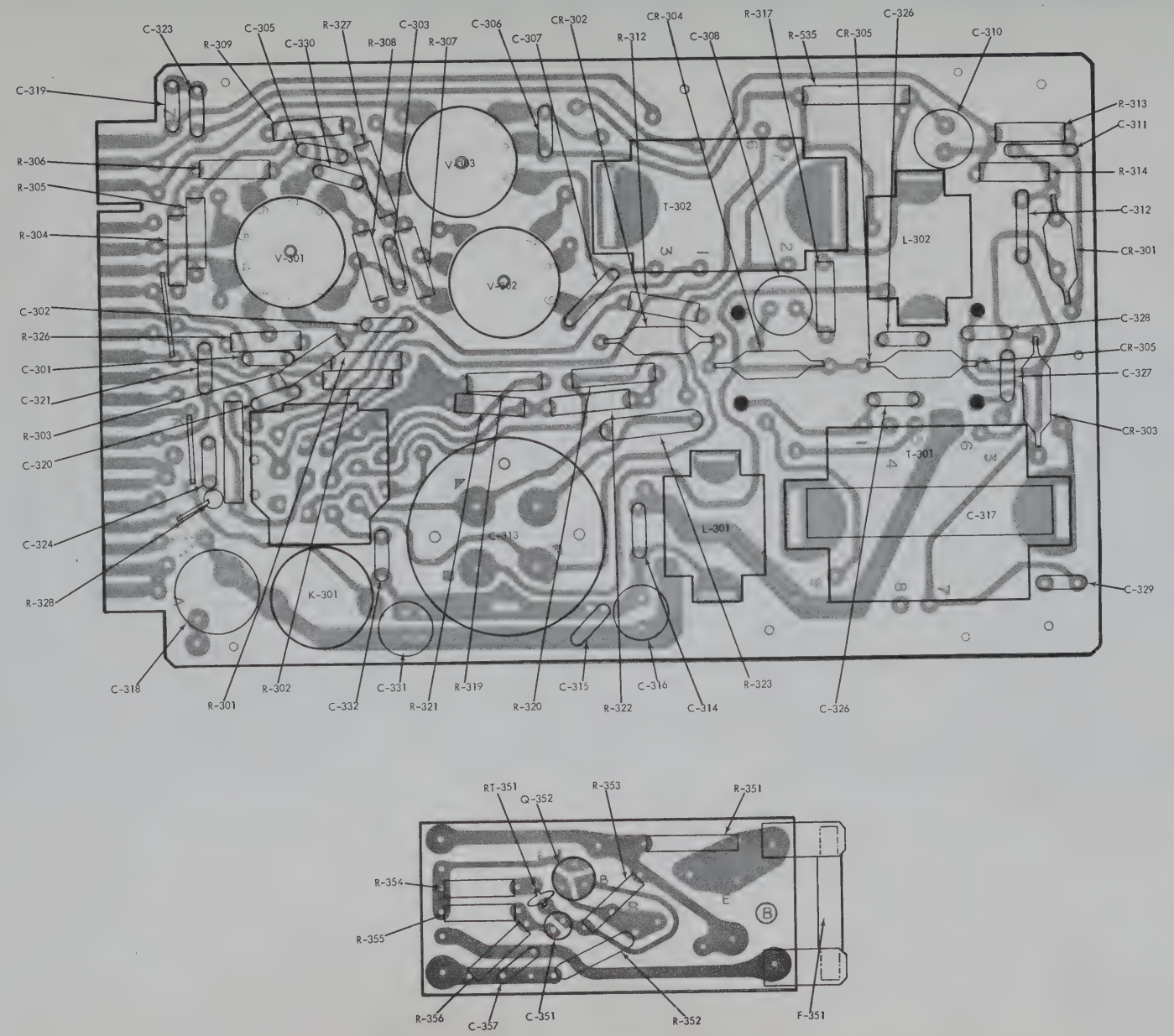


Figure 4-4. Etched Circuit Board Diagram of 2355 Power Supply - Amplifier - Modulator

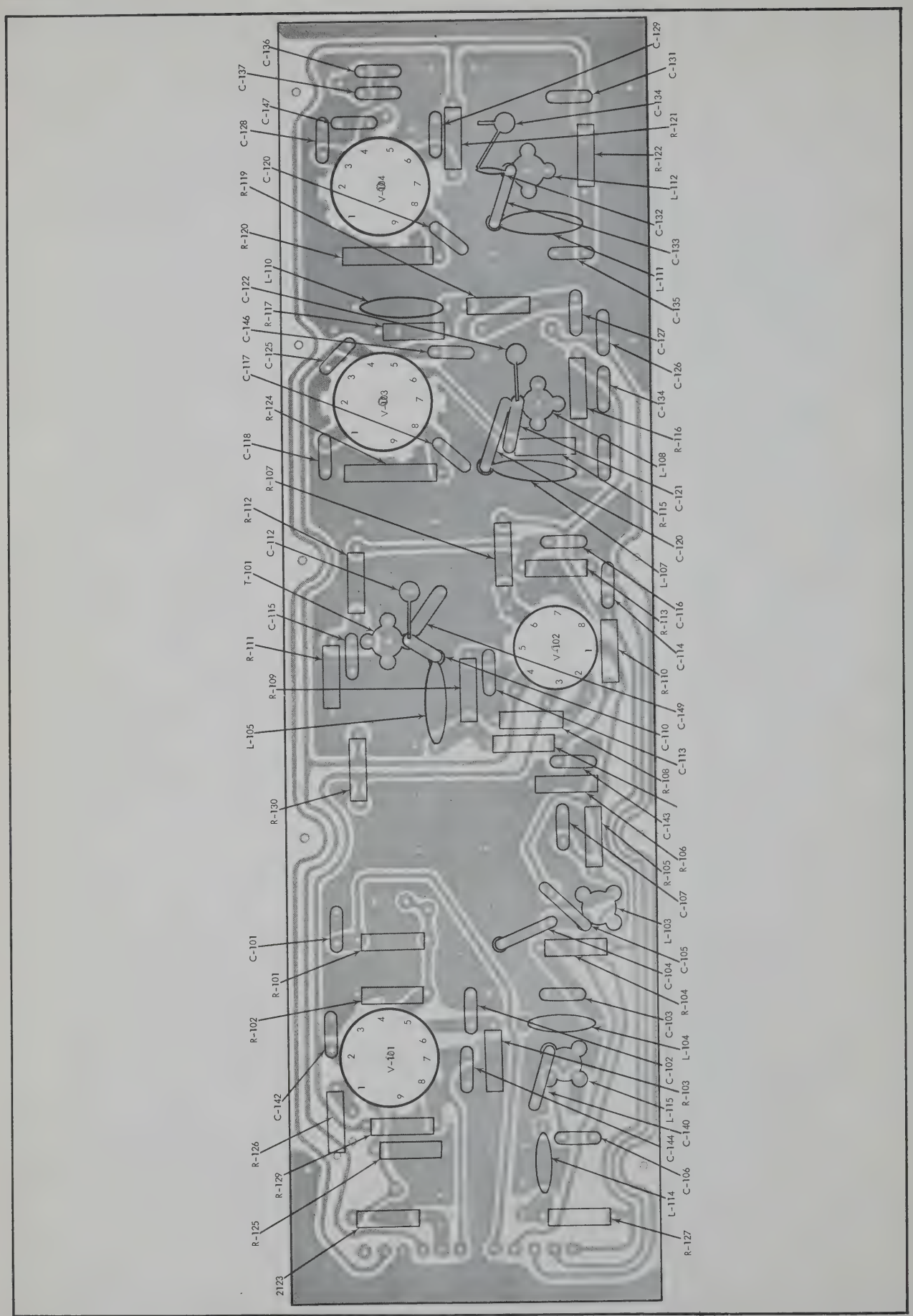


Figure 4-5. Etched Circuit Board Diagram of 5640A VHF Transmitter (As Seen from Bottom of Module)

TABLE 4-2. DC VOLTAGE DISTRIBUTION IN LNC-100 SYSTEM WITH 14 VOLT INPUT

MODULE	CONNECTOR	PIN NUMBER	DC VOLTS TO GROUND (RECEIVER POSITION)	DC VOLTS TO GROUND (TRANSMIT POSITION)
2355	P-301	A	14 (0)	14 (0)
		B	14 (0)	14 (0)
		C	0 (28)	0 (28)
		E	250	0
		F	125	0
		H	125	0
		K	14V	0
		M	14	10
		U	14	14
		X	0 (28)	0 (28)
		Y	0	250
		Z	0	250
5611A	P-203	1	14	14
		2	0 (28)	0 (28)
		7	14	14
		8	14	14
		10	-1 to -2	0
		11	125	0
5640A	P-101	1	14 (28)	14 (28)
		2	14	14
		3	0 (28)	0 (28)
		4	0	250
		5	0	250
2374	P-401			
		B	125	0
		K	-2	0
		L	14	14
		X	14	0
		2	250	0
		3	0 (28)	0 (28)

(2) Cut the loose ribbon from the etched circuit board and tin the ends still adhering to the circuit board for about 1/4 inch from each end.

(3) Place a piece of 24-gage tinned copper wire over the gap on the circuit board so that at least 1/4 inch of either end will overlap the 1/4-inch portions of the copper ribbon tinned in step (2) above.

(4) Solder each end of the wire to the copper ribbon.

(5) Using a small brush dipped in alcohol, remove the solder flux around the lead and the immediate area.

(6) Brush or spray a light film of clear lacquer over the new joint and surrounding area.

e. Thermal-Sensitive Components

In the assembly of these circuits it is sometimes necessary to solder heat-sensitive components such as transistors, crystal diodes, etc., directly to an etched board. When replacing these components, the lead being soldered should be firmly seized with a pair of pliers between the soldering iron and the component body. The pliers will then conduct most of the heat from the soldering iron as it travels along the component lead, thus avoiding internal component damage due to an excess of applied heat.

4.18.2 Module Layout Diagrams

Figures 4-2, 4-3, 4-4 and 4-5 are component layout diagrams of the Models 5611A, 2374, 2355, and 5640A modules respectively. They are designed to assist in the location of test points on the underside of the etched circuit boards during trouble-shooting and maintenance procedures. The view, in each case, is from the bottom of the etched circuit board, and the components outlined appear as they would if the etched circuit board were transparent.

4.18.3 D-C Voltage Distribution

Table 4-2 tabulates the distribution of the d-c voltages throughout the entire LNC-100 System, together with the corresponding test points for voltage measurements. For maximum performance the voltages listed in Table 4-2 should be present at the indicated terminals.

4.19 MODULE ISOLATION

Table 4-3 is designed to facilitate the isolation of a malfunction to a particular module, or module major section, of the LNC-100 System. To utilize the table, the system modules should be assembled as shown in Figure 4-1. The only test equipment required initially is the Collins 479S-3 audio signal generator, the Boonton 211-A r-f signal generator, the Hewlett Packard 608 signal generator, and the Hewlett Packard 200 audio generator. The General Radio 583A output meter, or a 3.2-ohm loudspeaker, may be connected to the audio output lead of the interconnect cable. Table 4-3 assumes the use of the speaker.

The isolation procedure consists of feeding the system, in sequence, appropriate signals to activate the different system facilities, i.e. VOR, localizer, audio reception, marker-beacon reception, and deducing the malfunctioning module from the observed results.

The abbreviations used in column 1 of Table 4-3 have the following meanings:

VOR (Omni-Range)	Tune the vhf receiver to a VOR channel. Apply to the input of the receiver an r-f signal, modulated by a composite audio VOR signal from the 479S-3 generator. Vary the PHASE ANGLE SELECTOR on the 479S-3 and observe the right-left pointer, the TO-FROM indicator, and the Flag Alarm in the Model 4087A navigation indicator.
LOC (Localizer)	Tune the vhf receiver to a localizer channel. Apply to the input of the receiver an r-f signal, modulated by a composite audio localizer signal from the 479S-3 generator. Vary the TONE LOCALIZER control on the 479S-3 and observe the right-left pointer, and the Flag Alarm in the Model 4087A navigation indicator.
VHF (Communication)	Tune the vhf receiver to a communication channel (120.5 mc). Apply to the input of the receiver an r-f signal modulated by 1000 cps at 30%, and listen to the loudspeaker or observe the output meter.
M.B. (Marker Beacon)	Apply a 75-mc signal to the input of the marker-beacon receiver. Modulate the r-f signal by 400, 1300, and 3000 cps in succession, at 95%. Listen to the loudspeaker or observe the output meter.

TABLE 4-3. VHF RECEIVER TROUBLE LOCALIZATION CHART

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
1. No receiver output. Audio or Navigation.	1. Connect output of r-f signal generator through 0.1 mfd capacitor to pin 1 of r-f amplifier V-201. Tune to 120.5 mc, modulated 30% at 1000 cps.	A. Receiver operates correctly.	Trouble is in antenna high-pass filter or grid input circuit of r-f amplifier V-201. Make stage-gain measurement.
		B. Receiver does not operate.	Continue with procedure #2.
	2. Connect output of r-f signal generator through 0.1 mfd capacitor to pin 2 of final i-f stage V-206. Tune to 3.1 mc, modulated 30% at 1000 cps.	A. Receiver operates correctly.	Continue with procedure #3.
		B. Receiver does not operate.	Trouble is in final i-f amplifier or 2nd detector (Sections A or B of V-206.) Make tube-check, voltage and resistance measurements, and stage gain measurement of V-206.
	3. Connect output of r-f signal generator through 0.1 mfd capacitor to pin 2 of 2nd mixer V-204A. Tune to 3.1 mc, modulated 30% at 1000 cps.	A. Receiver operates correctly.	Continue with procedure #4.
		B. Receiver does not operate.	Trouble is in 2nd mixer V-204A or fixed i-f amplifier V-205A. Make tube-check, voltage and resistance measurements, and stage gain measurements on V-204A and V-205A.
	4. Leave signal generator connected as in procedure #3 and increase frequency to 20.5 mc.	A. Receiver operates correctly.	Continue with procedure #5.
		B. Receiver does not operate.	Trouble is in tenth-megacycle oscillator V-204B. (See paragraph 4.20.3 for oscillator check.)
	5. Connect output of r-f signal generator to pin 2 of 1st mixer V-202A. Tune to 20.5 mc modulated 30% at 1000 cps.	A. Receiver operates correctly.	Continue with procedure #6.
		B. Receiver does not operate.	Trouble is in variable i-f amplifier V-203 or 1st mixer V-202A. Make tube-check, voltage and resistance measurements, and stage gain measurements on V-202A and V-203.
	6. Leave signal generator connected as in procedure #5 and increase frequency to 120.5 mc.	A. Receiver operates correctly.	Trouble is in r-f amplifier V-201. Make tube-check and voltage and resistance measurements.
		B. Receiver does not operate.	Trouble is in megacycle oscillator V-202B. See paragraph 4.20.3 for oscillator check procedure.

TABLE 4-3. VHF RECEIVER TROUBLE LOCALIZATION CHART (cont)

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
2. No audio output from receiver. Navigation output O. K.	1. Connect output of r-f signal generator to input receptacle of antenna high-pass filter. Tune to 120. 5 mc, modulated 30% at 1000 cps. Adjust signal generator output to 100 uv. Connect A-C VTVM to pin 7 of audio amplifier V-207.	A. VTVM reads audio voltage.	1. Audio amplifier V-207 defective. Check or replace. 2. R-240 open. Potentiometer R-248 open. Check for continuity. 3. R-236 open. Check for continuity. 4. Make voltage and resistance measurements on V-207 and compare with Tables 4-5 and 4-6.
		B. VTVM does not read audio voltage.	1. Noise limiter diode CR-201 open. Short out diode with shorting clip. 2. If audio appears replace diode. 3. R-227 or R-228 open. Check and replace. 4. C-234 shorted or disconnected from ground. Check or replace.
3. No audio output from navigation amplifier (pin 3, P-203). Audio output O. K.	1. Connect and adjust r-f generator as in symptom #2. Connect A-C VTVM to pin 9 of V-205B.	A. VTVM does not read audio voltage.	1. Open lead between pin 9 of V-205B and pin 9 of V-206B. Check and repair. 2. Capacitor C-248 open.
		B. VTVM reads correct audio voltage. (Approx. 1. 5 volts rms)	1. Potentiometer R-243 open or shorted. Check and replace. 2. Tube V-205B defective. Make tube-check and voltage and resistance measurements.
4. Excessive distortion in the audio output, as evidenced by the sound and erratic behaviour of the r-l pointer in VOR operation.	1. Connect and adjust r-f generator as in symptom #2. Connect vertical input of oscilloscope in sequence to: pin 8 of V-205B pin 9 of V-205B pin 9 of V-206B	A. If distortion disappears on scope pattern, it is being created in the circuit previously viewed.	1. Make tube-checks and voltage and resistance measurements. 2. Check all by-pass capacitors.
		B. If distortion does not disappear, it is being introduced prior to the 2nd detector.	1. AVC line is grounded or open. This can be due to capacitors C-267, C-264, C-222, C-214, or C-203 being shorted; or, resistors R-202, R-247, R-230, or R-229 being open. Check and replace.

TABLE 4-3. VHF RECEIVER TROUBLE LOCALIZATION CHART (cont)

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
4. (cont)			2. Check receiver alignment. 3. Check oscillator frequencies. 4. Open de-coupling capacitors can increase gain of a stage through re-generation.
5. Erratic audio output Level varies periodically. This indicates receiver is oscillating.	1. Localize oscillating stage by injecting signal in the following sequence: a. Disconnect pin 8 of V-206B and inject 1000 cps signal. Observe output meter.	A. Output reading steady. B. Output still oscillates.	1. Oscillation is further back in i-f or r-f stages. 1. Oscillation is in audio stages. Make tube checks of V-205, V-206, and V-207. Make voltage and resistance checks. 2. Check all by-pass capacitors especially C-233, C-267, and C-230.
	2. Disconnect pin 2 of V-206A and inject 1000 cps modulated 3.1 mc signal to pin 2 through 0.1 mfd capacitor and 100 k resistor connected from grid to ground.	A. Output reading steady B. Output still oscillates.	1. Oscillation is back in i-f or r-f stages. Continue with procedure #3. 2. Oscillation is in V-206A. Make tube-check and voltage and resistance measurements. Check all de-coupling capacitors in the stage.
	3. Repeat procedure #2 of the following stages until the oscillating stage is located. 3.1 mc (modulated) to pin 2 of V-205B and observe output. 3.1 mc (modulated) to pin 2 of V-204A and observe output. 20.5 mc (modulated) to pin 1 of V-203, and observe output. 120.5 mc to pin 2 of V-202A and observe output. 120.5 mc (modulated) to pin 1 of V-201 and observe output.		1. When an injected signal produces a steady output, the oscillation is in the following stage toward the audio output of the receiver. When the stage is isolated, make tube-check and voltage and resistance measurements. Check all de-coupling capacitors.
6. Low overall sensitivity.	1. Make stage gain measurements as outlined in paragraph 4.20.3 and compare with Table 4-4.	A. One stage has low gain.	1. Make tube-check and voltage and resistance measurements. 2. Check for open cathode by-pass capacitor.

4.20 TROUBLE-SHOOTING PRECAUTIONS

Before undertaking any of the trouble-shooting steps indicated in the succeeding paragraphs on the different system modules make the following checks:

a. Check primary d-c source voltage.

b. Check all d-c voltage inputs to the module under test, and compare with the values listed in Table 4-2.

c. Observe whether all tubes are lit.

d. Visually inspect for obvious faults such as broken leads, solder shorts, or overheated resistors etc.

e. If low sensitivites appear to be the only trouble, re-align before proceeding further.

4.21 TROUBLE-SHOOTING THE VHF RECEIVER (Module 5611A)

4.21.1 Preliminary Procedures

a. Assemble the equipment as shown in Figure 4-1 and connect the d-c primary supply.

b. Apply a modulated r-f signal to the input receptacle of the vhf receiver high-pass filter. (120.5 mc modulated at 30% by 1000 cps.)

c. Connect the A-C VTVM to pin 8 of navigation amplifier V-205.

d. Connect General Radio output meter to vhf receiver audio output. (Pin 4 on connector P-203 of the 5611A module.)

NOTE

If the audio amplifier section of the model 2355 module is known to be operating correctly the General Radio output meter may be connected to the audio output lead of the interconnect cable as shown in Figure 4-1.

e. Turn the audio volume control for maximum audio output, and the squelch control for minimum squelch action.

4.21.2 TROUBLE-SHOOTING TABLE 4-3 (VHF Receiver)

Table 4-3 is designed to localize faulty operation to a major section of the VHF receiver as rapidly as possible. Because of this, signals are injected into the grid inputs of the various stages without disconnecting the previous stage. As a result the tuned circuit of the previous stage will be de-tuned by the signal generator and act as a low-impedance shunt load. This requires that the signal generator be adjusted for a high output level in order to produce an output indication on the VTVM. The results of this procedure are strictly qualitative and are only intended to determine whether circuit continuity exists between the point of injection and the output. When the trouble has been localized to a major section of the receiver, more precise stage gain measurements should be made as outlined in paragraph 4.21.3 to finally locate the fault.

4.21.3 Stage Gain Measurements

When marginal performance or other malfunctions occur that cannot be readily located stage gain measurements should be performed as outlined below.

a. Connect r-f oscillator to input receptacle of high-pass antenna filter, and connect VTVM to pin 8 of V-205B.

b. Tune r-f generator and receiver to 120.5 mc, and modulate generator output with 1000 cps at 30%. Adjust output of generator until VTVM reads 1.0 volt, and record generator output voltage.

c. Disconnect pin 1 of V-201, and connect 100K resistor between pin 1 and ground.

d. Connect output of r-f generator to pin 1 of V-201 through 0.1 mfd capacitor, and adjust r-f generator output until VTVM reads 1 volt rms. Record generator output voltage.

e. Disconnect pin 2 of V-202A, and connect 100K resistor from pin 2 to ground.

f. Connect output of r-f generator to pin 2 of V-202A and increase output of r-f generator until VTVM reads 1 volt rms. Record generator output voltage.

g. Leave generator connected as in step f and reduce generator frequency to 20.5 mc. Adjust generator output voltage until VTVM reads 1 volt rms and record generator output voltage.

h. Disconnect pin 1 of V-203, and connect 100K resistor from pin 1 to ground.

i. Connect output of r-f generator to pin 1 of V-203 through 0.1 mfd capacitor.

j. Tune generator to 20.5 mc modulated 1000 cps at 30% and adjust generator output voltage until VTVM reads 1 volt rms. Record generator output.

k. Disconnect pin 2 of V-204A, and connect 100K resistor from pin 2 to ground.

l. Connect output of r-f generator (tuned to 20.5 mc) to pin 2 of V-204A through 0.1 mfd capacitor, and increase generator output until VTVM reads 1 volt rms. Record generator output.

m. Leave the generator connected as in step l and reduce frequency to 3.1 mc. Adjust generator output until VTVM reads 1 volt rms. Record generator output.

n. Disconnect pin 2 of V-205A, and connect 100K resistor from pin 2 to ground.

TABLE 4-4. VHF RECEIVER STAGE GAIN

SIGNAL INPUT TO	PIN NUMBER	FUNCTION	FREQUENCY (MEGACYCLES)	SENSITIVITY (MICROVOLTS)
Antenna	J-201	-	120.5 mc	2.0
V-201	1	R-f Amplifier	120.5 mc	3.0
V-202	2	1st Mixer	120.5 mc	15.0
V-202	2	1st Mixer	20.5 mc	2.5
V-203	1	Var. Freq. I-F	20.5 mc	20.0
V-204	2	2nd Mixer	20.5 mc	460.0
V-204	2	2nd Mixer	3.1 mc	80.0
V-205	2	1st Fixed I-F	3.1 mc	5600.0
V-206	2	2nd Fixed I-F	3.1 mc	200000.0

o. Connect output of r-f generator to pin 2 of V-205A through 0.1 mfd capacitor and tune generator to 3.1 mc. Adjust generator output until VTVM reads 1 volt rms. Record generator output.

p. Disconnect pin 2 of V-206A, and connect 100K resistor from pin 2 to ground.

q. Connect output of r-f generator to pin 2 through 0.1 mfd capacitor and tune generator to 3.1 mc. Adjust generator output until VTVM reads 1 volt rms. Record generator output.

NOTE

The AVC line is grounded in the above sensitivity measurements, and the output of the signal generator is connected through a 6 db 52 ohm pad.

4.21.4 VHF Receiver Stage Gain Table.

Table 4-4 records sensitivity data of a typical model 5611A vhf receiver. The measurements were made in accordance with the procedure outlined in paragraph 4.21.3. Sensitivities at the noted locations are based upon signal strengths sufficient to provide a 1.0 volt rms output at the cathode of the navigation amplifier (V-205B). Variations of up to 6 db are not uncommon for individual stage gains. However, antenna sensitivity should not fall below that stated.

4.21.5 VHF Receiver Oscillator Checks.

a. Unit Megacycle Oscillator (V-202B) Check

(1) Tune receiver to 108.99 mc.

(2) Set VTVM for negative reading and connect d-c VTVM through 10K resistor to pin 9 of V-202B, and observe reading.

(3) Rotate Megacycle Control from 108.00 to 130.00 mc in 1 mc increments and note reading on VTVM for each frequency.

(4) The negative d-c voltage at the grid of V-202B should be between 0.7 and 1.5 volts for all positions of the Megacycle Control switch.

b. Tenth-Megacycle Oscillator (V-204B) Check

(1) Tune receiver to 120.00 mc.

(2) Set VTVM for negative d-c reading and connect through 1 megohm isolating resistor to pin 9 of V-204B, and observe reading.

(3) Rotate Tenth-Megacycle Control switch from 120.00 to 120.90 mc in tenth (0.1) megacycle increments, and note reading on VTVM for each frequency.

(4) The negative d-c voltage at the grid of V-204B should be between - 1.5 and - 2.5 vdc for all positions of the Tenth-Megacycle Control switch.

4.21.6 Voltage and Resistance Charts (VHF Receiver)

The measurements tabulated in Tables 4-5 and 4-6 were made under the following conditions:

a. Tube Socket Voltage Measurements: The antenna was disconnected from the receiver. Measurements are made from the terminals indicated to ground with a Hewlett Packard 410B voltmeter. The squelch is in the maximum clockwise position.

b. Tube Socket Resistance Measurements: Receiver disconnected from the power supply (or interconnect cable). Measurements made with Hewlet Packard 410B voltmeter. The squelch control is in the maximum clockwise position.

TABLE 4-5. MODEL 5611A VHF RECEIVER TUBE SOCKET VOLTAGES

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-201	-1.3	0.0	0.0	6.0	145.0	118.0	0.0	--	--
V-202	85.0	-0.68	38.0	6.4	12.4	145.0	0.0	--	-0.06
V-203	-0.72	0.27	6.0	12.4	145.0	63.0	0.0	--	--
V-204	122.0	-0.20	56.0	6.4	0.0	145.0	1.4	1.4	0.0
V-205	150.0	-0.65	110.0	6.4	0.0	140.0	0.8	5.1	0.0
V-206	-0.34	0.0	100.0	6.4	12.4	140.0	1.0	10.0	8.5
V-207	60.0	8.2	17.0	0.0	12.4	120.0	60.0	60.0	6.4

4.21.7 Auxiliary Equipment Control Switching Check

a. Connect the d-c voltmeter to pin 11 of connector P-203 of the Model 5611A module.

b. Tune the Model 5611A module sequentially to the twenty localizer frequencies listed in Table 3-3.

c. The voltmeter shall read 14 or 28 vdc nominal for each of the localizer frequencies.

d. Connect an ohmeter sequentially between pins 1 through 10 of connector P-202, and pin 6 of connector P-203 and tune the receiver through the localizer frequencies in the 109.0 and the 110.0 megacycle bands. Continuity should be observed as follows:

	CONTINUITY INDICATED BETWEEN	
LOCALIZER FREQUENCY	CONNECTOR P-202 PIN #	CONNECTOR P-203 PIN #
109.1	6	6
109.3	7	6
109.5	8	6
109.7	9	6
109.9	10	6
110.1	1	6
110.3	2	6
110.5	3	6
110.7	4	6
110.9	5	6

TABLE 4-6. MODEL 5611A VHF RECEIVER TUBE SOCKET RESISTANCES

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-201	6M	0.0	5.5	5.5	14K	24K	0.0	--	--
V-202	20K	360K	250K	4.8	3.2	15K	0.0	0.0	10K
V-203	5M	54.0	5.5	3.2	15K	13K	50.0	--	--
V-204	20K	110K	125K	4.8	5.5	15K	100.00	100.0	10K
V-205	16K	5M	32K	2.0	0.0	15K	100.0	10K	5M
V-206	2.2M	0.2	32K	2.0	3.0	16K	100.0	33K	52K
V-207	115K	5M	2.5K	0.0	3.0	48K	117K	8K	4.0

4.21.8 Disassembly Procedures Model 5611A VHF Receiver (Refer to Figure II-2)

a. General

(1) By removing three screws (132) and washers (133) from the receiver rear plate (114), the unit may be withdrawn through the front end of cover (131), exposing all components.

(2) All tubes may be readily removed from their sockets and replaced. The receiver rarely will require replacement of other parts.

(3) Pin leads from the i-f transformers pass through the assembly board and are soldered to the printed circuit on the board bottom A transformer may be withdrawn a little at a time from the board after the pin leads have been loosened in succession by a soldering iron.

(4) Most capacitors, resistors, and coils have one or both leads passing through and soldered to the printed circuit on the bottom of the board. They may be removed and replaced with a soldering iron.

(5) Potentiometers, control knobs, dials, shafts, switch wafers, crystal mount boards, and other items are mechanically attached and the procedure for their removal and replacement is, in most instances, readily apparent from a visual study of the receiver and Figure II-2. Break interfering electrical lead connections with a soldering iron. Reconnect the leads at reassembly.

(6) Replacement procedures are provided in the following paragraphs for those components whose removal requires preparatory disassembly of parts.

CAUTION

Do not disturb locknut (61) and bushing (59) as the bushing has been factory-set to maintain correct shaft alignment. Disturbance of this alignment will result in serious damage to wafer switch contacts.

b. Replacement of Volume Control Potentiometer

(1) Remove tubes V-205 and V-207, and i-f transformer T-202, to provide working space.

(2) Remove upper and lower nuts (73) and washers (72). Push back screws (71) and remove potentiometer (88) and its mounting bracket (87).

(3) Replacement is the reverse of disassembly.

c. Replacement of Volume Control Shaft

(1) Remove two Allen head set screws (2) and pull volume control knob (1) off shaft (91).

(2) Pry apart tips of forward grip ring (93) near inner end of shaft and withdraw shaft through front of receiver.

(3) Replacement of the volume control shaft will require removal of potentiometer (88) and bracket (87), as in paragraph 4.20.8b together with spacer (94), to permit reassembly of forward grip ring (93) over the shaft end. Otherwise, reassembly is the reverse of disassembly.

d. Replacement of Fractional-MC Crystals

(1) Some fractional-mc crystals are accessible for replacement without disassembling other parts. In these cases use soldering iron to release crystal leads from crystal mount board and wafer contact. Remove crystal.

(2) To reach any crystal not readily accessible, first remove potentiometer (88) and bracket (87) as in paragraph 4.20.8b.

(3) Retract two screws (71) and remove spacers (86) and (94) and nylon washers (85). Crystal mount board (81), with wafer (80) and crystals (82) mounted in an assembly, may now be pulled back and rotated sufficiently to provide access. With soldering iron break crystal lead connections to crystal mount board and wafer contact and remove crystal.

(4) Replacement of crystal and other removed parts is the reverse of disassembly.

e. Replacement of Fractional-MC Crystal Mount Board Assembly and Control and Standby Wafers

(1) Remove potentiometer (88) and bracket (87) as in paragraph 4.20.8b.

(2) Remove spacer (94) and forward grip pin (93).

(3) Retract screws (71) and remove spacers (94), (86), and (84), and nylon washers (85).

(4) With soldering iron break all necessary electrical connections and slide crystal mount board (81), together with wafer (80) and crystals (82) mounted in an assembly, and wafers (79) and (78) off rear end of fractional-mc shaft (74).

(5) Replacement of wafers and crystal mount board assembly is the reverse of disassembly.

f. Replacement of MC Crystals

(1) Most mc crystals are readily replaced without disassembly of other parts. In those receiver models where a few crystals are difficult of access, proceed as follows:

(2) Remove two nuts (119), two screws (118), and lug (120), and pull antenna jack connector (117) out of the way.

(3) Disconnect all jumper leads from wafers and crystal mount boards from bottom of assembly board (109).

(4) Remove 10 screws (110) and carefully pull assembly board (109) outward from the chassis frame to the extent other leads may permit.

(5) If short leads to board prevent access to crystal, disconnect those leads.

(6) Tilt board as necessary and disconnect leads of crystal. Remove crystal.

(7) Replacement of crystal, terminal board, jumper leads, and antenna jack connector is the reverse of disassembly.

g. Replacement of Panel Light Lamp

(1) Unscrew lampholder cap (25) and pull out lamp (26).

(2) Replacement of lamp (26) and cap (25) is the reverse of disassembly.

4.22 TROUBLE-SHOOTING THE VOR CONVERTER

4.22.1 General

The trouble-shooting procedures outlined in the succeeding paragraphs assume that the malfunctions have been isolated to the VOR Converter section of the model 2374 module by the methods outlined in Table 4-1. This assumes that the Localizer section of the model 2374 module is functioning correctly, which in turn indicates that the models 4080 or 4087 navigation indicators are operating correctly.

4.22.2 Preliminary Procedures

a. Assemble the model 2374 module to the interconnect cable as illustrated in figure 4-1, and close the primary power ON/OFF switch or circuit breaker.

b. Check the d-c voltages on connector P-401 against the values tabulated in Table 4-2.

c. Remove the perforated cover from the model 2374 module and visually inspect that all the tubes are lit, and for obvious electrical or mechanical defects.

d. Disconnect the 5611A module from the interconnect cable.

e. Connect the output of the Collins 479S-3 generator directly to pin H of connector P-401 of the model 2374 module.

f. Connect the a-c VTVM to pin H of connector P-401 of the model 2374 module.

NOTE

Make certain that the Collins 479S-3 audio generator is calibrated. (See paragraph 4.4)

g. Set the FUNCTION SELECTOR switch on the 479S-3 generator to the ODR postion, and set the SPECIFIC SIGNAL SELECTOR switch to the composite signal position (9960 FM 30 CPS VAR. PHASE).

h. Adjust the output voltage of the 479S-3 until the VTVM connected to pin H reads 0.95 volt rms.

i. Adjust the PHASE ANGLE SELECTOR control on the 479S-3 to zero degrees, and the O.B.S. knob on the model 4087 (or 4080) navigation indicator to zero degrees.

j. Connect the right-left, to-from, and flag microammeters to pins N and M, Y and I, and W and U, respectively of connector P-401.

CAUTION

Refer to paragraph 4.8.2 steps e through i before connecting the test microammeters.

NOTE

The right-left, to-from and flag microammeters provide an accurate quantitative measurement of the quantities displayed qualitatively on the models 4080 and 4087 navigation indicators. The navigating indicators, however, may be used for trouble-shooting if the microammeters are not available.

TABLE 4-7. VOR CONVERTER TROUBLE-SHOOTING

SYMPTOM	PROCEDURE	RESULTS	CONCLUSION
1. VOR converter is operating incorrectly. Right-Left pointer has a constant deflection although O. B. S. is adjusted for centering. To-from flag and microammeter read normally. Flag shows OFF, and flag microammeter reads 140 microamps.	1. Rotate O. B. S. knob through 360 degrees.	A. Right-left pointer in indicator and microammeter centers at 90 degrees has maximum deflection at 270 degrees.	1. Bridge rectifier consisting of diodes CR-408, CR-409, CR-410, and CR-411 is defective or disconnected from ground. Check ground connection and repair. Check diodes by measuring forward and reverse resistance and replace if necessary. 2. Resistor R-450 open. Check and replace.
2. Similar to Symptom #1 except that deflection is in opposite direction, and flag microammeter reads approximately 180 microamps.	1. Repeat procedure #1.	A. Right-left pointer in indicator and microammeter centers at 270 degrees and reaches maximum deflection at 90°.	1. Bridge rectifier consisting of diodes CR-411, CR-412, CR-413 and CR-414 is defective or disconnected from ground. Check ground connection and repair. Check diodes by measuring forward and reverse resistance, and replace if necessary. NOTE: In either bridge rectifier two diametrically opposite diodes, e.g., CR-408, CR-409 must open to stop the rectifier from functioning. 2. Resistor R-453 is open. Check and replace.
3. Right-left pointer in indicator and microammeter centered. To-from pointer in indicator and microammeter centered. Flag shows OFF and flag microammeter reads 140 microamps. (Approx.)	1. Rotate O. B. S. knob through 360 degrees and observe microammeters.	A. No change.	1. The reference channel is in-operative. Use VTVM to make reference channel measurements, and compare readings with those listed in Table 4-8. NOTE: Scope may also be used to find point where signal disappears.

TABLE 4-7. VOR CONVERTER TROUBLE-SHOOTING (cont)

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
4. Similar to Symptom #3 except flag microammeter reads 180 microamps. (Approx.)	1. Rotate O. B. S. knob through 360 degrees and observe microammeters.	A. No change.	1. The variable channel is in-operative. Use VTVM to make variable-channel measurements, and compare readings with those listed in Table 4-8.
5. All three microammeters read zero.	1. Rotate O. B. S. knob and observe microammeters.	A. No change.	1. Composite signal amplifier defective. Make tube-check (V-401A) and voltage and resistance measurements. 2. Relay K-401 energized or defective. Check and repair.
6. Right-Left pointer centered and inactive. Flag meter reads zero. To-from meter reads correctly.	1. Rotate O. B. S. knob through 360 degrees and observe meters.	A. No change except to-from meter goes from TO to FROM and registers correct current.	1. Wiper open in potentiometer R-455. Replace.
7. Cannot obtain typical or minimum performance accuracy.	1. Check waveform at TP-406 with oscilliscope.	A. Waveform clipped, or distorted.	1. Slope detector L-402, C-413 improperly tuned. Re-tune.
8. Erratic Indications on all instruments.	1. Check reference and variable channel waveforms at plate of V-402A and grid of V-401B.	A. Waveforms indicate inadequate limiting.	2. Make tube-check and voltage and resistance measurements on V-402A and V-401, and replace if necessary.
9. Tracking error varies as O. B. S. knob rotated through 360 degrees.	1. Connect a-c VTVM to pin 1 of V-405 and rotate O. B. S. knob through 360 degrees.	A. Voltage reading varies in amplitude with position of O. B. S. knob.	1. Capacitor C-433 or resistors R-443 or R-444 shorted or open. Check and replace.
10. All instruments read correctly except to-from meter remains centered when O. B. S. varied through 360 degrees, i. e. does not read TO or FROM.	1. Connect d-c voltmeter from anode of CR-401 to junction of R-451 and R-454; and then connect voltmeter from anode of CR-404 to junction of R-451 and R-454. (O. B. S. and Collins both set to zero degrees.)	A. One reading relatively high; the other almost zero. B. Both readings equal. C. Both readings zero.	1. Relay K-401 defective. Check and repair. 2. Capacitors C-441, C-442 open or shorted. 3. Center-tap disconnected on winding 8, 9, 10 of T-401 or T-402. Check wiring and repair.

TABLE 4-8. VOR CONVERTER STAGE GAIN

VARIABLE-PHASE CHANNEL				REFERENCE-PHASE CHANNEL			
TUBE CONNECTOR OR COMPONENT	PIN#	VOLTAGE	FREQUENCY	TUBE, CONNECTOR OR COMPONENT	PIN#	VOLTAGE	FREQUENCY
V-401	1	10	Composite	V-401	1	10	Composite
V-401	7	1.65	30 cps	V-402	1	1.0	9960 cps.
V-401	8	1.4	30 cps	V-402	9	19.0	9960 cps.
P-401	J	0.14	30 cps	V-402	6	7.5	9960 A.M. 30 cps
V-405	7	0.014	30 cps	R-469	high side	2.6	30 cps
V-405	6	0.16	30 cps	V-403	2	2.6	30 cps
V-405	2	0.15	30 cps	V-403	8	1.3	30 cps
V-405	1	2.5	30 cps	V-403	1&6	43.0	30 cps
V-406	7	2.5	30 cps	T-401	1	43.0	30 cps
V-406	8	1.3	30 cps	T-401	3	43.0	30 cps
V-406	1&6	40.0	30 cps	T-401	4&5	3.5	30 cps
T-402	1	40.0	30 cps	T-401	6&7	3.5	30 cps
T-402	3	38.0	30 cps	T-401	8&10	15.0	30 cps
T-402	4&5	3.4	30 cps				
T-402	6&7	3.4	30 cps				
T-402	8 10	14.0	30 cps				

4.22.3 Stage Gain Measurements: VOR Converter

When marginal performance or other malfunctions occur that cannot be readily located, stage gain measurements should be performed as outlined below.

a. Follow the preliminary procedures outlined in paragraph 4.21.2, with the exception that the test microammeters do not need to be connected.

b. Make sure that the equipment is properly aligned as detailed in paragraph 4.13.

c. With a composite VOR signal input of 0.95 volts rms, and the O.B.S. knob centered on a selected bearing make voltage measurements at the points indicated in table 4-8. Some of the points indicated are high-impedance circuits. In these cases a calibrated oscilloscope should be used to make the measurement.

4.22.4 Voltage and Resistance Charts (Model 2374 module)

The voltage and resistance measurements tabulated in Tables 4-8 and 4-9 apply to the VOR Converter, the Localizer Converter, and the 75 MC Marker Beacon Receiver, all of which are located in the model 2374 module. Measurements were made with the Marker Beacon antenna disconnected and with zero inputs to the Localizer and VOR Converters. The 2374 module was connected into the system interconnect cable for the voltage measurements and disconnected for the resistance measurements. A Hewlett Packard 410B was employed.

4.23 TROUBLE-SHOOTING THE LOCALIZER CONVERTER

4.23.1 General

The trouble-shooting procedures outlined in the succeeding paragraphs assume that the malfunctions have been located to the Localizer section of the model 2374 module by the methods outlined in Table 4-1. This assumes that the VOR Converter section of the model 2374 module is functioning correctly, which in turn indicates that the models 4080 or 4087 navigation indicators are operating correctly.

TABLE 4-9. MODEL 2374 MODULE TUBE SOCKET VOLTAGES

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-401	50.0	0.0	1.4	0.0	12.5	130.0	0.0	5.8	-
V-402	19.5	0.0	1.1	6.3	12.6	-27.0	0.0	0.0	130.0
V-403	245.0	0.0	50.0	12.6	0.0	240.0	0.0	50.0	-
V-404	125.0	0.0	120.0	6.3	12.6	155.0	0.5	6.2	0.0
V-405	175.0	0.0	1.5	0.0	12.6	175.0	0.0	1.5	-
V-406	225.0	0.0	50.0	12.6	0.0	240.0	0.0	50.0	-
V-407	75.0	0.0	125.0	0.0	6.3	125.00	1.4	0.0	- 3.0

4.23.2 Preliminary Procedures

a. Assemble the model 2374 module to the interconnect cable as illustrated in figure 4-1, and close the primary power ON/OFF switch or circuit breaker.

b. Check the d-c voltages on P-401 against the values tabulated in Table 4-2.

c. Remove the perforated cover from the model 2374 module and visually inspect that all the tubes are lit. Check for obvious electrical or mechanical defects.

d. Disconnect the model 5611A module from the interconnect cable.

e. Connect the output of the Collins 479S-3 generator directly to pin H of connector P-401 of the model 2374 module.

f. Connect the a-c VTVM to pin H of connector P-401 of the model 2374 module.

NOTE

Make certain the Collins 479S-3 audio generator is calibrated. (See paragraph 4.4)

g. Connect the right-left, to-from, and flag microammeters to pins N and M, Y and I, and W and U, respectively, of connector P-401.

h. Set the FUNCTION SELECTOR switch on the 479S-3 generator to the TONE LOC position, and set the SPECIFIC SIGNAL SELECTOR switch to the 90-150 CPS position.

TABLE 4-10. MODEL 2374 MODULE TUBE SOCKET RESISTANCES

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-401	-	2.7M	650	0.0	2.6	70K	270K	2.5K	-
V-402	-	1.3M	2.4K	2.0	5.5	2M	-	0.0	-
V-403	-	1.0M	6.0K	3.0	0.0	-	1M	6K	-
V-404	-	-	1M	22.0	2.2	-	150.0	-	1M
V-405	-	1.1M	1.6K	9.0	2.4	-	-	1.6K	-
V-406	-	1.0M	5.5K	2.2	9.0	-	1M	5.5	-
V-407	-	5.0M	-	0.0	7.5	-	200.0	-	9M

TABLE 4-11. LOCALIZER CONVERTER TROUBLE-SHOOTING

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
1. Right-left pointer deflected to the left. Cannot be centered with centering potentiometer R-428. Right-left microammeter reads approx. 130 microamps. Flag microammeter reads low (approx. 135 microamps.)	1. Adjust TONE LOCALIZER control to the 4 db 150 cps, and then to the 4 db 90 cps positions, and observe the right-left microammeter.	A. At the 4 db 150 cps position the right-left microammeter current increases to about 150 microamps. At the 4 db 90 cps position the microammeter decreases to about 90 microamps.	Diodes CR-405, or CR-406, or the inputs to diodes (pin 2 of L-403 or L-404) shorted to ground. Check by using a-c VTVM to measure voltage at pin 2 of L-403 and L-404. VTVM should read 1.9 v rms at each position. If a-c readings O.K. use d-c VTVM to measure from TP-407 to TP-408, and then from cathode of CR-406 to TP-407. VTVM should read 0.8 vdc in both cases. Lack of VTVM reading indicates which diode or coil is grounded.
2. Right-left microammeter moves extreme right (approx. 200 us). Flag micraommeter reads low (approx. 100 ua).	1. Check with VTVM for d-c (about 0.8 vdc) from TP-408 to TP-407, and for a-c (1-9 vac).	A. No reading for d-c, but a-c meter reads. B. No reading for a-c or d-c.	1. CR-405 shorted across. 2. CR-405 open. Check and replace.
3. With 0 db signal right-left meter deflects extreme left (approx. 200 ua). Flag meter drops to approx. 100 ua.	1. Check with VTVM for d-c (about 0.8 vdc) from cathode of CR-406 to TP-407. Check with VTVM for a-c reading.	A. No reading for d-c, but a-c meter reads. B. No reading a-c or d-c.	1. CR-406 shorted across. Check and replace. 2. CR-406 open. Check and replace.
4. Localizer appears to be indicating O.K. but deflection current low. (Cannot obtain 90 ua for 4 db points on 479S-3).	1. Use a-c VTVM to measure signal volts at plate (pin 6) of V-404A.	A. Reading below 26 vac.	1. Weak tube V-404A. Plate voltage should be 26 vac for 0.95 vac input. If tube O.K. continue procedure #2.
	2. Check capacitor C-410 for open circuit.	B. C-410 open.	2. Replace. C-410 open makes circuit degenerative and lowers gain.

i. Set the TONE LOCALIZER switch to 0 and adjust the MASTER ATTENUATOR control on the 479S-3 until the a-c VTVM reads 0.95 volt rms.

4.22.3 Stage Gain Measurements: Localizer Converter

When marginal performance or other malfunctions occur that cannot be readily located, stage gain measurements should be performed as outlined below.

a. Follow the preliminary procedures outlined in paragraph 4.22.2 with the exception that the test microammeters do not need to be connected.

b. Make sure the equipment is properly aligned as detailed in paragraph 4.14.

c. With the 479S-3 adjusted for a localizer signal of 0.95 v rms and the TONE LOCALIZER set to 0 db make voltage measurements at the points indicated in Table 4-12.

TABLE 4-12. LOCALIZER CONVERTER STAGE GAIN

TUBE OR COMPONENT	PIN #	VOLTAGE
R-410	High Side	0.95 vac
V-404A	6	26.00 vac
L-403	3	18.00 vac
L-403	2	1.9 vac
L-404	2	1.9 vac
Cathode CR-405	TP-407 to TP-408	0.8 vdc
Cathode CR-406	Cathode CR-406 to TP-408	0.8 vdc

4.22.5 Voltage and Resistance Measurements

For tube socket voltage and resistance measurements on the Localizer Converter refer to Tables 4-9 and 4-10.

4.23 75 MC Marker Beacon Receiver

4.23.1 Preliminary Procedures

a. Connect the output of the 75 mc r-f signal generator to pin D of connector P-401 of the model 2374 module. The frequency must be 75.00 mc plus or minus 0.01%. (See figure 4-1.)

b. Modulate r-f generator at 95% with 1300 cps signal from audio generator, and adjust output of r-f generator to 2000 microvolts.

c. Connect a-c VTVM to pin A of connector P-401, and adjust marker beacon sensitivity control (located on front panel of the model 5611A module) for maximum sensitivity.

4.24 TROUBLE-SHOOTING THE POWER SUPPLY (Model 2355 Module)

4.24.1 General

The most expedient method of troubleshooting the power supply is to connect the module into the complete LNC-100 system as shown in figure 4-1. When the power supply is not interconnected with the other modules in the LNC-100 system, dummy loads must be substituted as follows:

a. Connect a 6000 ohm 25 watt resistor from pin E of connector P-301 to ground, and simultaneously a 1000 ohm 50 watt resistor from pin H of connector P-301 to ground. These resistors function as dummy loads for the model 2374 module and the model 5611A module respectively.

TABLE 4-13. MARKER BEACON RECEIVER TROUBLE-SHOOTING

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
No output on VTVM when modulated signal applied to input.	1. Connect VTVM to TP-403	A. VTVM reads approx. 0.8 vac.	1. Cathode-follower V-404B defective. Make voltage and resistance measurements and check the tube. Replace tube.
		B. No reading on VTVM.	1. V-407A or V-407B defective. Connect with procedure #2.
	2. Connect d-c VTVM to pin 9 of V-407A, and adjust for negative reading.	A. VTVM reads approx. -0.3 vdc.	1. Trouble is probably in V-407B section or associated circuit L-406.
		B. VTVM does not read.	1. Trouble is probably in V-407A or associated circuits. If tube O.K. check R-466, R-468, or R-421 for open.
Receiver has audible oscillation	1. Connect VTVM to TP-403.	A. VTVM reading varies periodically.	1. C-445 open. 2. C-420 open.

TABLE 4-14. POWER SUPPLY TROUBLE-SHOOTING CHART

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
1. Power Supply appears completely inoperative. No audible vibration of DC-AC Converter present. All amplifier tubes unlit. No d-c voltages present on connector P-301 as per Table 4-2.	Check with d-c voltmeter for 14 vdc between pins B and L of P-301.	A. Voltmeter reads zero.	1. Check primary source supply. 2. Check interconnecting cable from primary supply to pins B and L. 3. Check power ON/OFF switch or circuit breaker.
		B. Voltmeter reads O.K.	1. Pin L of P-301 must be disconnected. Check for continuity and repair.
2. No B+ voltages present on P-301 as per Table 4-2. Vibration of DC-AC converter audible. 14 vdc present at pins A, D, K, M, and U of P-301.	Measure a-c voltage between pins 7 and 9 of transformer T-301.	A. Voltmeter reads O.K. (Approx. 300 vac).	1. Check whether ground at junction of CR-302 and CR-303 in bridge rectifier is open. 2. Check diodes CR-302, CR-303, CR-304, and CR-305 for forward and reverse resistance and replace if necessary.
		B. Voltmeter reads zero a-c volts.	1. Check secondary of T-301 for open circuit.
3. Vibration of DC-AC Converter not audible. No B+ voltages present at P-301. 14 vdc present as in symptom #2.	Check for d-c voltage at pins 2 and 5 of T-301.	A. Pins 2 and 5 both read approx. 14 vdc.	1. Transistors Q-301, or Q-302 defective. Replace. 2. Open primary winding in T-301. Check for continuity.
		B. Pin 2 reads 14 vdc, pin 5 zero volts.	1. Open resistors R-319 or R-320. 2. Defective relay contacts on K-301.
		C. Pin 2 and pin 5 of T-301 both read zero volts d-c.	1. Choke L-301 open. Check for continuity and replace.
4. All d-c voltages present on P-301 except 136 vdc at pin H and F.	Measure for 136 vdc at pin 8 of T-301 and ground.	A. Voltage present.	1. Resistor R-323 open. Check for continuity and replace. 2. Defective contact on relay K-301. Check for continuity and repair. 3. Check connections H and F to connector P-301 for continuity.
		B. Voltage reads zero.	1. Center-tap, pin 8, disconnected from T-301 secondary winding. Check and repair.

TABLE 4-14. POWER SUPPLY TROUBLE-SHOOTING CHART (cont)

SYMPTOM	PROCEDURE	RESULT	CONCLUSION
5. All d-c voltages present on P-301 except no 290 vdc at pin E in RECEIVE, and no 290 vdc at pins Y and Z in TRANSMIT position of TRANSMIT-RECEIVE switch.	Check for 290 vdc at output side of L-302.	A. Voltmeter reads zero.	1. Choke L-302 open.

b. To check the power supply on transmitter operation connect a 2800 ohm 50 watt resistor from pin Y of connector P-301 to ground, and simultaneously a 4100 ohm 50 watt resistor from pin Z of connector P-301 and ground.

c. A 3.2 ohm 10 watt resistor or General Radio Output Meter should be connected to pin J of connector P-301 and ground.

4.24.2 Preliminary Procedures

These procedures and the subsequent trouble-shooting chart assume that the power supply is interconnected into the complete LNC-100 system.

a. Assemble the model 2355 module to the LNC-100 system through the interconnect cable as shown in figure 4-1, and close the primary power ON/OFF switch or circuit breaker.

b. Check the d-c voltages present on connector P-301 against the values listed in Table 4-2 for both the transmit and receive positions of the microphone TRANSMIT-RECEIVE switch. If any of the voltages are low or absent refer to Trouble-Shooting Table 4-14.

4.25 TROUBLE-SHOOTING THE AUDIO AMPLIFIER (Model 2355 Module)

4.25.1 General

The audio amplifier is located in the model 2355 module, and functions as a power amplifier for the vhf and marker beacon receivers, and as a modulator for the vhf transmitter. If the unit is not operating in either the TRANSMIT or RECEIVE positions of the TRANSMIT-RECEIVE switch, tube socket voltage and resistance measurements should be made and compared with the values listed in Tables 4-15 and 4-16, respectively. If marginal performance is encountered stage gain measurements should be made as outlined in paragraph 4.25.2.

4.25.2 Audio Amplifier Stage Gain Measurements.

a. Assemble the model 2355 module to the LNC-100 system as shown in figure 4-1.

b. Connect the output of the audio generator through the audio coupling circuit to the audio input lead of the interconnect cable (2355-M). See figure 4-6 for circuit details of the audio coupling circuit.

TABLE 4-15. TUBE SOCKET VOLTAGES - AUDIO POWER AMPLIFIER

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-301	105.00	0.0	1.7	0.0	13.0	100.0	0.0	1.65	
V-302	290.00	0.0	-25.0	13.0	0.0	-25.0	0.0	290.0	290.0
V-303	290.00	0.0	-25.0	13.0	0.0	-25.0	0.0	290.0	290.0

Measurement Conditions: The model 2355 module was connected into the LNC-100 system through the interconnect cable as shown in figure 4-1. Primary power connected but no signal input applied to the audio amplifier. The TRANSMIT - RECEIVE switch was in the RECEIVE position.

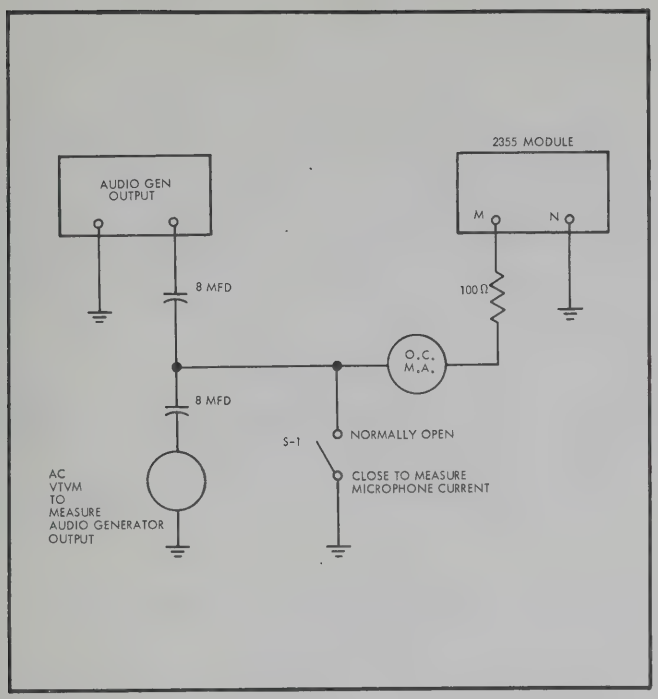


Figure 4-6. Audio Coupling Circuit Schematic

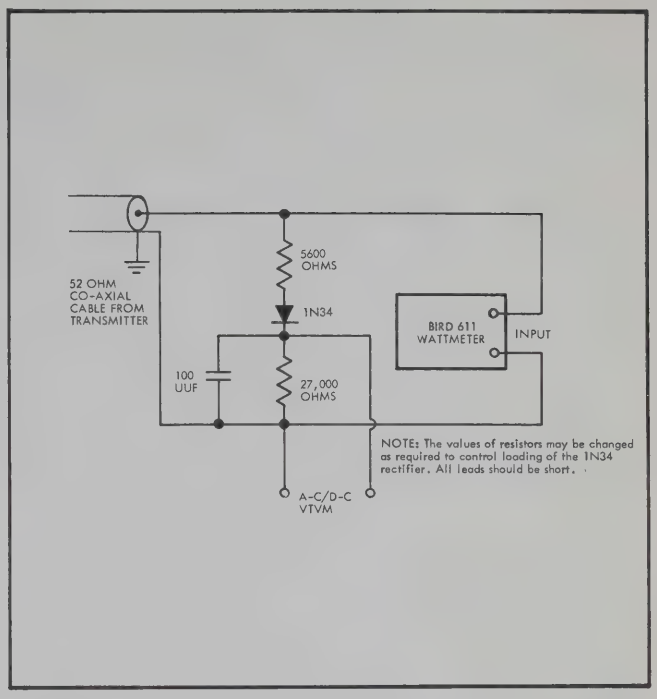

52 OHM CO-AXIAL CABLE FROM TRANSMITTER
5600 OHMS
1N34
BIRD 611 WATTMETER
INPUT
100 UUF
27,000 OHMS
NOTE: The values of resistors may be changed as required to control loading of the 1N34 rectifier. All leads should be short.
A-C/D-C VTVM

Figure 4-7. Linear Detector Circuit Schematic

c. Adjust the output of the audio generator to 1 volt rms at 1000 cps.

d. Make signal voltage measurements as indicated in Table 4-17.

4.26 TROUBLE-SHOOTING THE VHF TRANSMITTER

4.26.1 Preliminary Procedures

a. Connect the model 5640A module to the LNC-100 system through the interconnect cable as shown in figure 4-1.

b. Connect the transmitter output (J-102) through 6 feet of 52 ohm co-axial cable, and the linear detector circuit (see figure 4-7) to the Bird 611 Wattmeter.

c. Connect the output of the audio signal generator through the audio coupling circuit (see figure 4-6) to the audio input lead (2355-M) of the interconnect cable.

d. Close primary power ON/OFF switch or circuit breaker.

e. Place microphone TRANSMIT-RECEIVE switch in TRANSMIT position, and check d-c voltages on connector P-101 against the values listed in Table 4-2.

4.26.2 TROUBLE-SHOOTING PROCEDURE

a. Adjust output of audio generator to 1 volt rms at 1000 cps, and observe Bird Wattmeter.

b. Pointer on Bird Wattmeter should vibrate periodically, with the application of the modulation signal.

c. If no vibration observed make test point measurements with a VTVM (d-c) and compare with the values listed in Table 4-18.

TABLE 4-16. TUBE SOCKET RESISTANCES - AUDIO POWER AMPLIFIER

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-301	260K	47K	1.3K	0.0	12.0	260K	520.0K	1.3K	
V-302	120K	-	290.0K	12.0	18.0	290K	-	120K	
V-303	120K	-	290.0K	12.0	18.0	290K	-	120K	120K

TABLE 4-17. AUDIO AMPLIFIER STAGE GAIN MEASUREMENTS

TUBE#	PIN#	VOLTAGE
V-301	2	0.3 V
V-301	1	24.0 V
V-301	7	0.32 V
V-301	6	23.0 V
V-302	3	23.0 V
V-303	3	22.0 V

When test-point measurements indicate that a stage is inoperative or operating marginally check the alignment of the stage as outlined in paragraph 4-16. If re-alignment does not eliminate the malfunction check the tube and make voltage and resistance measurements as indicated in Tables 4-19 and 4-20 respectively.

4.26.3 DISSASSEMBLING THE MODEL 5640A VHF TRANSMITTER (SEE FIGURE II-1)

a. By removing three screws (90) and internal tooth lockwashers (89) from rear plate (75), the transmitter may be withdrawn through the front end of cover (88), exposing all components.

b. All tubes may readily be removed from their sockets and replaced. The transmitter rarely will require replacement of other parts.

c. Most capacitors, resistors, and coils have one or both leads passing through and soldered to the printed circuit on the bottom of the assembly board. These and all other soldered leads may be unsoldered and the parts removed. Coil mounting legs also pass through the board and are soldered to ground on the bottom of the board. After coil leads are unsoldered the legs may be loosened by a soldering iron and the coils removed. Replacement of parts is the reverse of disassembly.

d. MC crystals (39) may be removed and replaced with a soldering iron, breaking or resoldering crystal lead connections at crystal mount board and wafer contacts.

e. Control knobs, shafts, dials, switch wafers, crystal mount boards, and other items are mechanically attached and their removal and replacement procedures are, in most cases, readily apparent from a visual study of the transmitter and Figure II-1. Where electrical leads interfere, break the interfering connection with a soldering iron. Reconnect the lead at reassembly.

CAUTION

Do not disturb locknut (48) and bushing (46) as the bushing has been factory-set to maintain correct shaft alignment. Disturbance of this alignment will result in serious damage to wafer switch contacts.

4.26.4 Replacement of Fractional-MC Crystal and Crystal Mount Board

a. Individual fractional-mc crystals (52) may be removed and replaced with a soldering iron without removing the crystal mount board and wafer from the transmitter.

b. To replace as a unit assembly fractional-mc crystal mount board and crystals (52), wafer (55), and resistors (53, 54), remove four screws (74) and matching self-locking nuts and pull rear plate (75) out of the way. Remove two Allen head set screws (2) and withdraw knob (1) from front end of fractional-mc shaft (58). Remove two nuts (51), two lock washers (50), two screws (49), and two each spacers (56) and (57). Withdraw shaft (58) with assembled wafer (59) from rear of transmitter. Crystal mount board assembly with crystals (52), wafer (55), and resistors (53, 54) may now be removed as a unit.

c. Replacement is the reverse of disassembly.

4.26.5 Replacement of Panel Light Lamp

a. Unscrew lampholder cap (16) and pull out lamp (17).

b. Replacement of lamp (17) and cap (16) is the reverse of disassembly.

TABLE 4-18. TRANSMITTER TEST POINT MEASUREMENTS

TUBE #	STAGE	TEST-POINT	VOLTAGE WITHOUT MODULATION	VOLTAGE WITH MODULATION
V-101B	KILOCYCLE OSC.	TP-101	- 6.6 vdc	- 6.6 vdc
V-101A	MEGACYCLE OSC.	TP-102	- 3.8 vdc	- 3.8 vdc
V-102	MIXER	TP-103	- 2.8 vdc	- 2.8 vdc
V-103	DRIVER	TP-104	- 3.2 vdc	- 3.2 vdc
V-104	FINAL AMP.	TP-105	-26.0 vdc	-27.5 vdc

TABLE 4-19. TUBE SOCKET VOLTAGES: VHF TRANSMITTER

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-101A	230.0	0.0	1.30	0.0	0.0	240.0	0.0	3.0	7.0
V-102	-2.8	3.2	7.0	13.7	265.0	205.0	3.2	-	-
V-103	5.5	-3.2	5.4	13.75	7.0	260.0	265.0	5.8	260.0
V-104	7.0	-26.0	7.0	7.0	0.0	260.0	265.0	7.2	264.0

Conditions: Transmitter Un-modulated

TABLE 4-20. TUBE SOCKET RESISTANCES: VHF TRANSMITTER

	PINS								
TUBE	1	2	3	4	5	6	7	8	9
V-101	-	5K	100	11.5	11.5	-	10K	220	8.5
V-102	10K	220	8.5	5.6	-	-	220	-	-
V-103	100	10K	100	5.5	3.0	-	-	100	-
V-104	100	10K	100	3.0	-	-	-	100	-

Conditions: All power disconnected from Transmitter

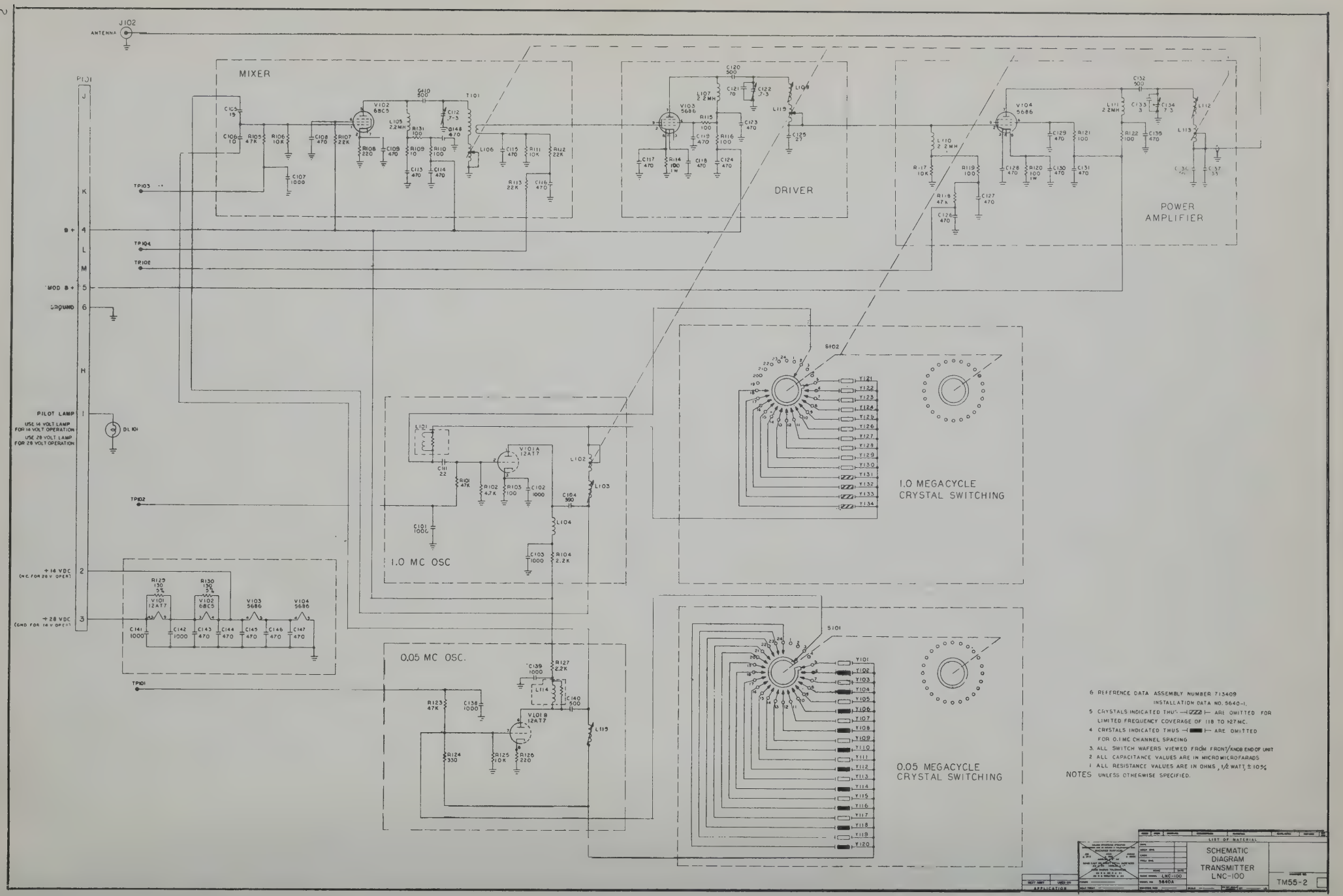
APPENDIX I

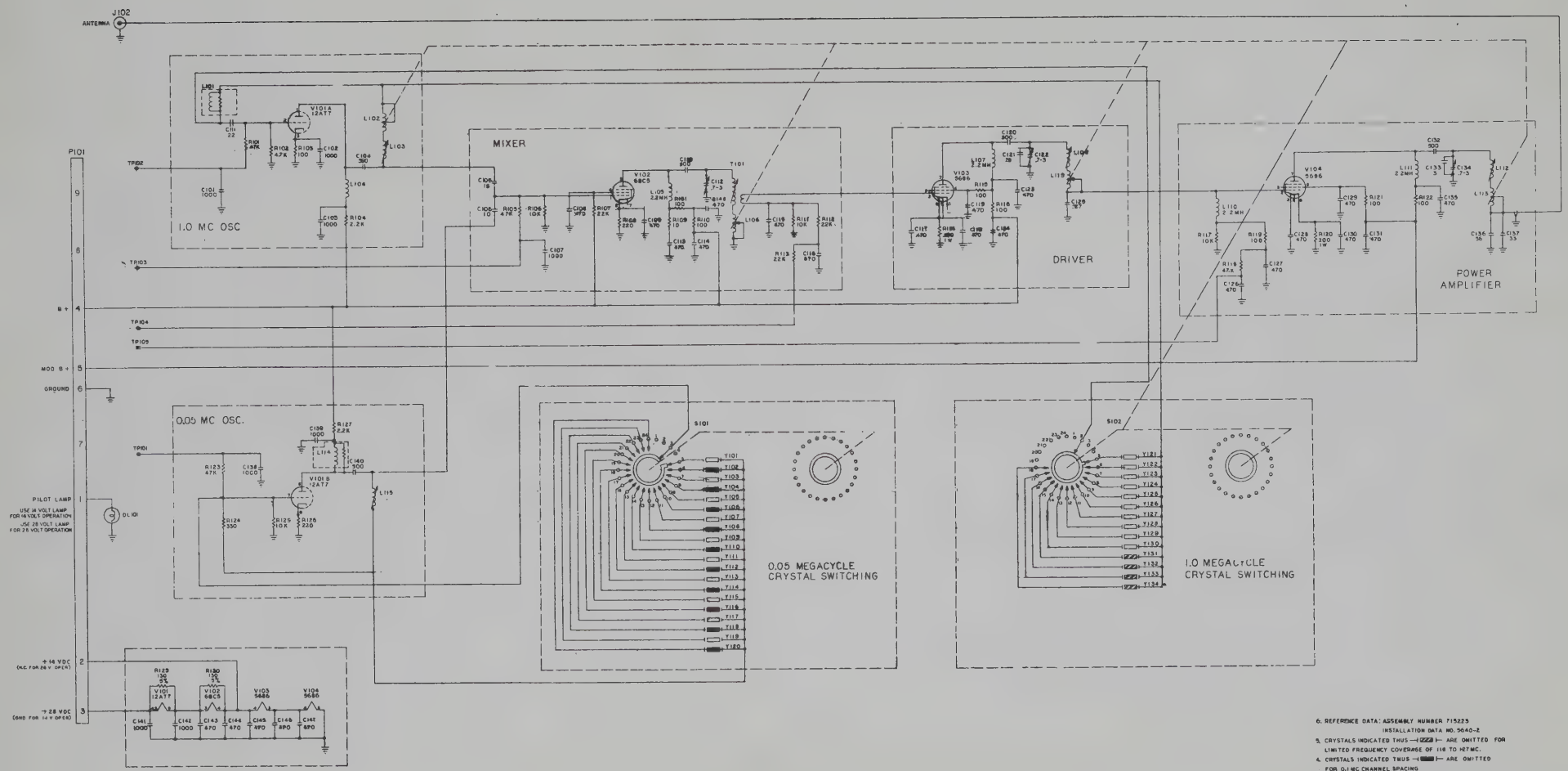
DRAWINGS

NOTE

The schematics for each of the units that make up the LNC-100 System have had minor changes made on them since the theory and maintenance section was written. These are included to make this manual as complete as possible. However, because of these revisions, minor discrepancies may be found between the maintenance section and the unit being repaired. Therefore, it is important to check carefully to see that the schematic revision letter of the unit being repaired matches the revision letter of the schematic used.

The Model 2355 Power Supply was written to the G revision of schematic 713401.
The Model 5611A Receiver was written to the ABC revision of schematic 715052.
The Model 5640A Transmitter was written to the E revision of schematic 713410.
The Model 2374 Localizer was written to the E revision of schematic 713404.

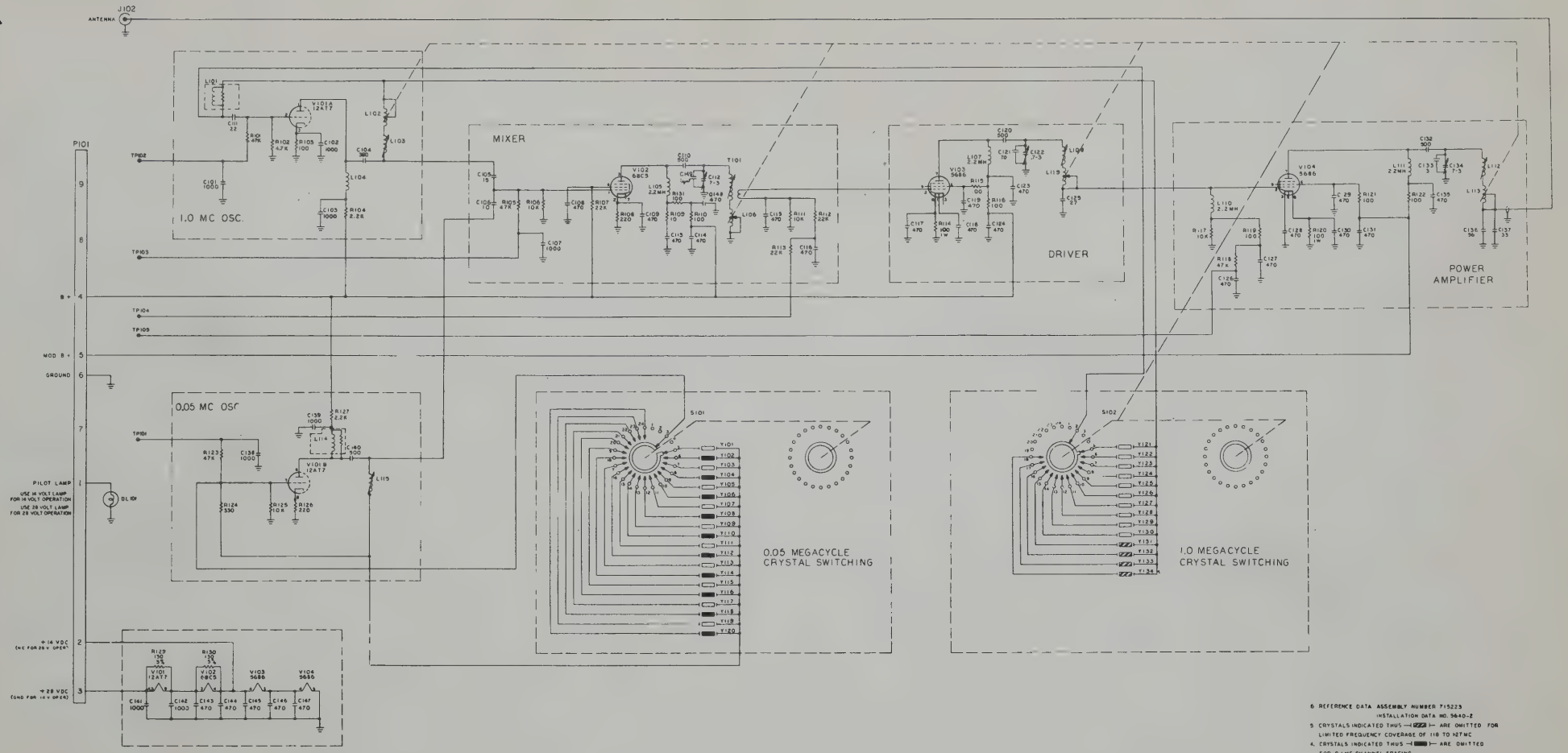

J102
ANTENNA
P101
J
K
B+ 4
L
M
MOD B+ 5
GROUND 6
H
PILOT LAMP 1
USE 14 VOLT LAMP FOR 14 VOLT OPERATION
USE 28 VOLT LAMP FOR 28 VOLT OPERATION
DL 101
+14 VDC (N.C. FOR 28 V OPER.) 2
+28 VDC (GND FOR 14 V OPER.) 3
TP103
TP104
TP105
TP102
TP101
MIXER
V102 6BC5
T101
DRIVER
V103 5686
POWER AMPLIFIER
V104 5686
1.0 MC OSC
V101A 12AT7
0.05 MC OSC.
V101B 12AT7
V101 12AT7
V102 6BC5
V103 5686
V104 5686
S102
1.0 MEGACYCLE CRYSTAL SWITCHING
S101
0.05 MEGACYCLE CRYSTAL SWITCHING
6 REFERENCE DATA ASSEMBLY NUMBER 713409
INSTALLATION DATA NO. 5640-1.
5 CRYSTALS INDICATED THUS ARE OMITTED FOR LIMITED FREQUENCY COVERAGE OF 118 TO 127 MC.
4 CRYSTALS INDICATED THUS ARE OMITTED FOR 0.1 MC CHANNEL SPACING
3 ALL SWITCH WAFERS VIEWED FROM FRONT/KNOB END OF UNIT
2 ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
1 ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ± 10%
NOTES UNLESS OTHERWISE SPECIFIED.
LIST OF MATERIAL
SCHEMATIC DIAGRAM TRANSMITTER LNC-100
LNC-100
5640A
TM55-2



6. REFERENCE DATA: ASSEMBLY NUMBER 715225
   INSTALLATION DATA NO. 5640-E
5. CRYSTALS INDICATED THUS —|ZZZ|— ARE OMITTED FOR LIMITED FREQUENCY COVERAGE OF 118 TO 127 MC.
4. CRYSTALS INDICATED THUS —|■■■|— ARE OMITTED FOR 0.1 MC CHANNEL SPACING
3. ALL SWITCH WAFERS VIEWED FROM FRONT/KNOB END OF UNIT.
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT ± 10%.

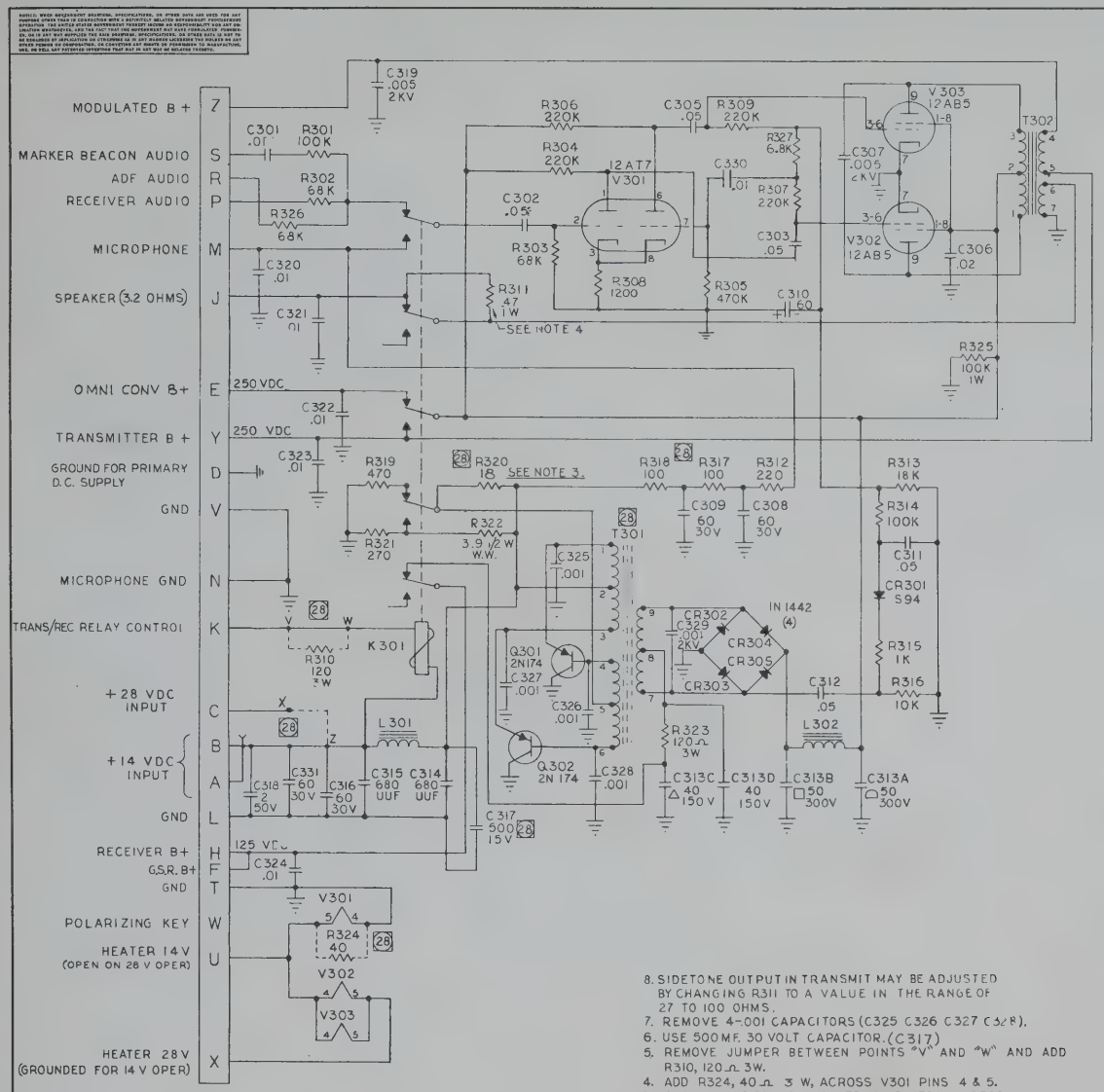
NOTES: UNLESS OTHERWISE SPECIFIED.

MODEL 5640A | 7/3410
SHEET 1 OF 2



6 REFERENCE DATA ASSEMBLY NUMBER 715223
INSTALLATION DATA NO. 5640-E
5 CRYSTALS INDICATED THUS ⊣▭⊢ ARE OMITTED FOR LIMITED FREQUENCY COVERAGE OF 118 TO 127MC
4. CRYSTALS INDICATED THUS ⊣■⊢ ARE OMITTED FOR 0.1MC CHANNEL SPACING
3. ALL SWITCH WAFERS VIEWED FROM FRONT/KNOB END OF UNIT
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT ± 10%
NOTES UNLESS OTHERWISE SPECIFIED

MODEL OR SPEC NO. 5640A 713410
MADE ON LINE-1809



8. SIDETONE OUTPUT IN TRANSMIT MAY BE ADJUSTED BY CHANGING R311 TO A VALUE IN THE RANGE OF 27 TO 100 OHMS.
7. REMOVE 4-.001 CAPACITORS (C325 C326 C327 C328).
6. USE 500 MF. 30 VOLT CAPACITOR. (C317)
5. REMOVE JUMPER BETWEEN POINTS "V" AND "W" AND ADD R310, 120Ω 3W.
4. ADD R324, 40Ω 3 W, ACROSS V301 PINS 4 & 5.
3. CHANGE RESISTANCE VALUES: R319, 4700Ω; R320, 1Ω-3 W W.W. R321, 2200Ω; R317 270Ω, R318, 270Ω.
2. CHANGE T301 TO 28 VOLT TRANSFORMER S17055.
1. REMOVE JUMPER BETWEEN POINTS "Y" AND "Z" & ADD JUMPER BETWEEN POINTS "X" AND "Z"

[28] FOR 28 VOLT OPERATION:

14 VOLT OPERATION SHOWN.

3. 10Ω 1/2 WATT MAY BE SUBSTITUTED IN SOME 14 VOLT UNITS.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	RELEASED		
B	SEE ECO 14649		
C	SEE ECO 15094		
D	SEE ECO 15627		
F	SEE ECO 15715		

713401 E

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES

LIST OF MATERIAL

SCHEMATIC DIAGRAM MODEL 2355 A/B POWER SUPPLY & MODULATOR

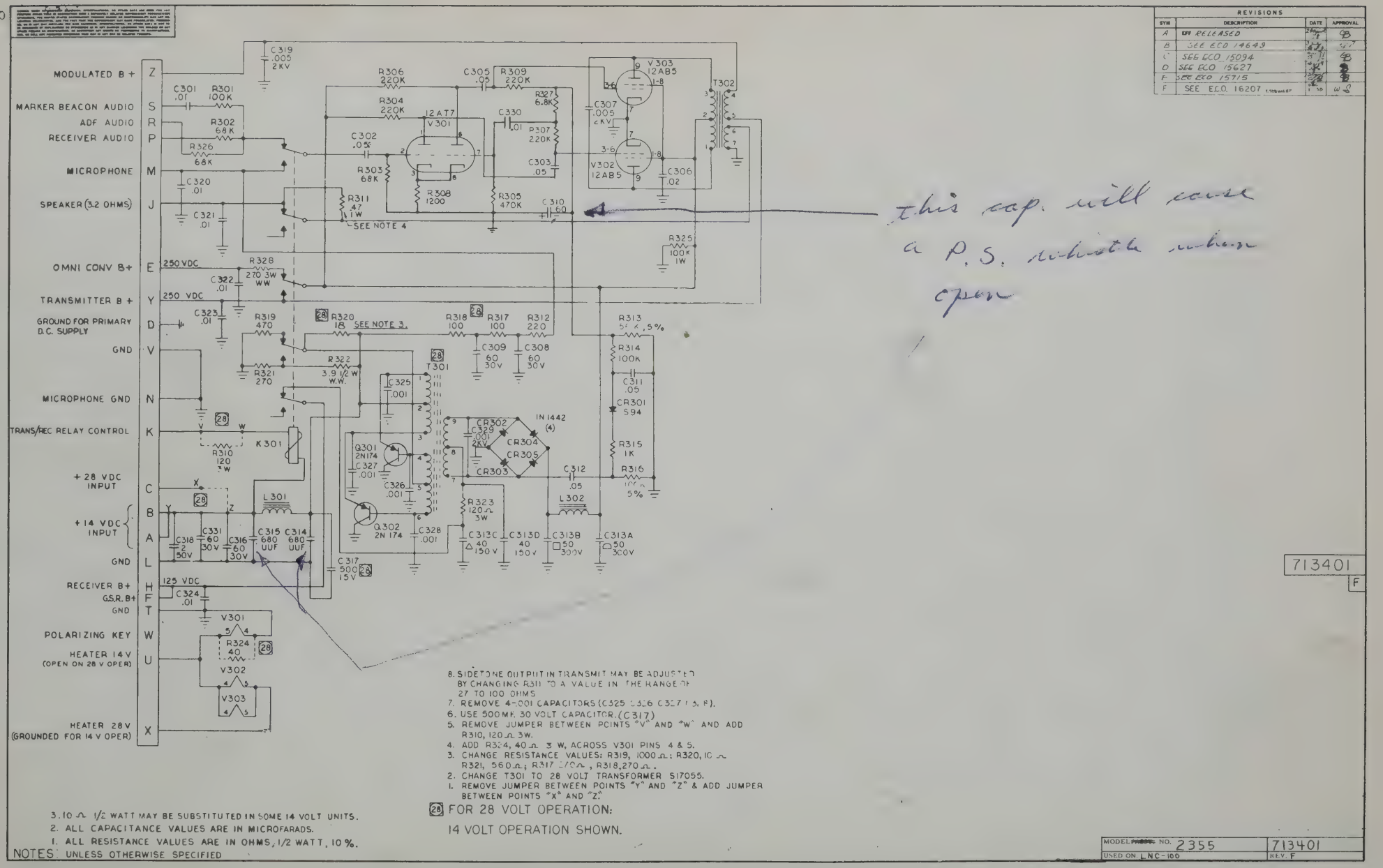
DRAWING NO. 713401 E

MECH. ENG.
CHKR.
PROJ. ENG.
NAME / DATE
BASIC MODEL MINCOM
MODEL NO. 2355A/B
DRAWING SIZE D
SCALE
WT. LB.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES & TOLERANCES ARE.
MACHINED SURFACES
.XX ±.03 .XXX ±.005 .XXXX ±.0005
ANGLES ± 0° 30'
SAND CAST OR SHEET METAL SURFACES
.XX ± .03 ANGLES ± 1°
BEND RADIUS TOLERANCES
.03 R to .06 R ± .01
.09 R & GREATER ± .03

FINISH
HEAT TREAT

SEE DR. 713476 2355 A/B
NEXT ASSY USED ON
APPLICATION



this cap. will cause a P.S. problem when open

8. SIDETONE OUTPUT IN TRANSMIT MAY BE ADJUSTED BY CHANGING R311 TO A VALUE IN THE RANGE OF 27 TO 100 OHMS
7. REMOVE 4-001 CAPACITORS (C325, C326, C327, & C328).
6. USE 500 M.F. 30 VOLT CAPACITOR. (C317)
5. REMOVE JUMPER BETWEEN POINTS "V" AND "W" AND ADD R310, 120Ω 3W.
4. ADD R324, 40Ω 3 W, ACROSS V301 PINS 4 & 5.
3. CHANGE RESISTANCE VALUES: R319, 1000Ω; R320, 10Ω R321, 560Ω; R317 270Ω, R318, 270Ω.
2. CHANGE T301 TO 28 VOLT TRANSFORMER S17055.
1. REMOVE JUMPER BETWEEN POINTS "Y" AND "Z" & ADD JUMPER BETWEEN POINTS "X" AND "Z"

[28] FOR 28 VOLT OPERATION:

14 VOLT OPERATION SHOWN.

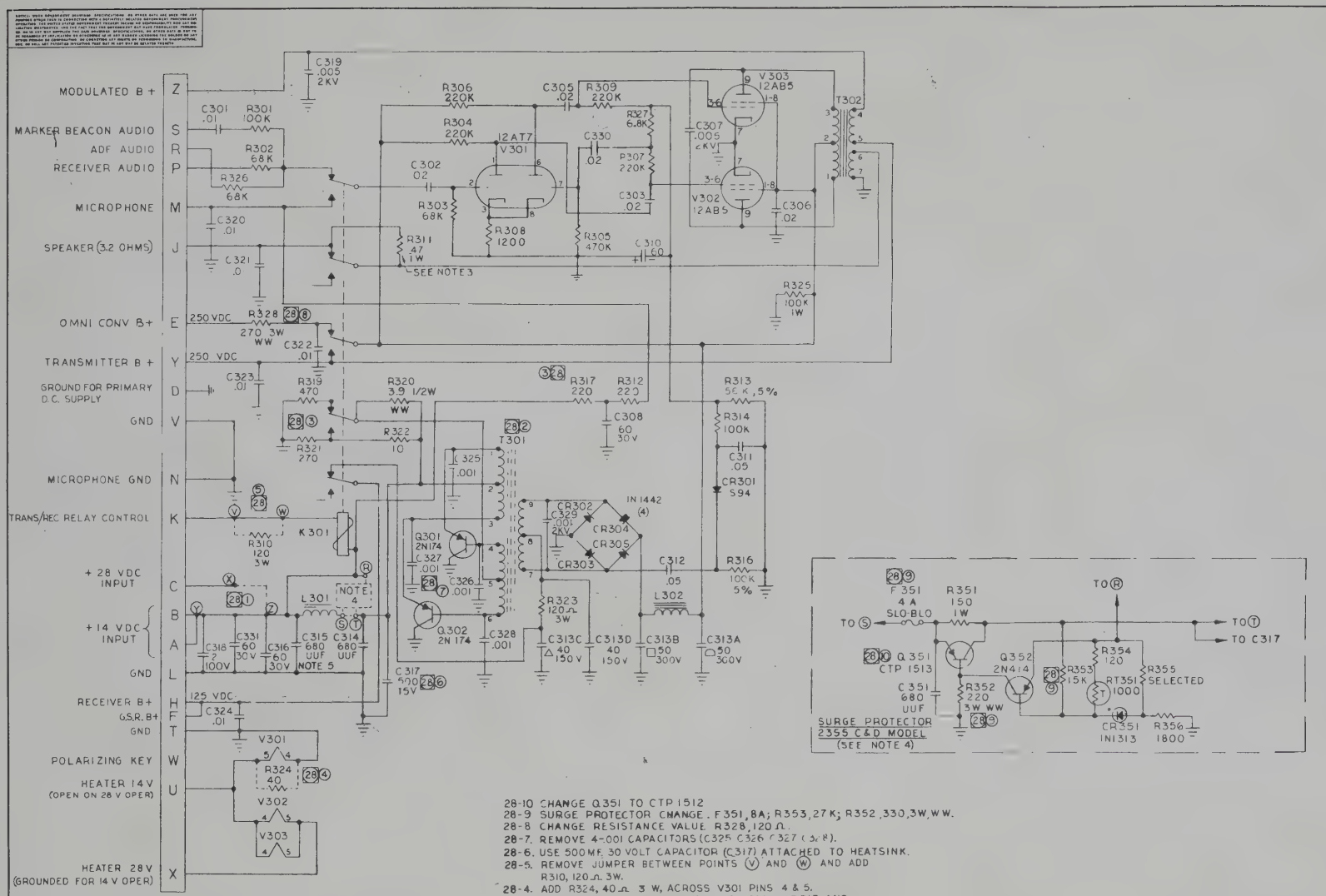
3. 10Ω 1/2 WATT MAY BE SUBSTITUTED IN SOME 14 VOLT UNITS.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	2-[illegible]-64	GB
B	SEE ECO 14649	4-21-64	GB
C	SEE ECO 15094	9-[illegible]-64	GB
D	SEE ECO 15627	10-[illegible]-64	GB
E	SEE ECO 15715	12-[illegible]-64	GB
F	SEE E.C.O. 16207	1-10-65	GB

713401 F

MODEL NO. 2355	713401
USED ON LNC-100	REV. F



REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	2-8-67	CB
P	SEE ECO 14649	6-7-67	
C	SEE ECO 15094	8-31-67	CB
D	SEE ECO 15627	10-31-67	CB
E	SEE ECO 15715	12-28-67	CB
F	SEE ECO 16207 EFFECTIVE S/N 1-36	DEC 1-36	W.S
G	ECO 16468 ADDED MODELS 38 S/N 2-	FEB 2-L	CB

713401 G

28-10 CHANGE Q 351 TO CTP 1512
28-9 SURGE PROTECTOR CHANGE. F351, 8A; R353, 27K; R352, 330, 3W, WW.
28-8 CHANGE RESISTANCE VALUE R328, 120Ω.
28-7. REMOVE 4-.001 CAPACITORS (C325 C326 C327 C328).
28-6. USE 500 MF. 30 VOLT CAPACITOR (C317) ATTACHED TO HEATSINK.
28-5. REMOVE JUMPER BETWEEN POINTS (V) AND (W) AND ADD R310, 120Ω 3W.
28-4. ADD R324, 40Ω 3 W, ACROSS V301 PINS 4 & 5.
28-3. CHANGE RESISTANCE VALUES: R319, 1000Ω; R317 AND R321, 560Ω.
28-2. CHANGE T301 TO 28 VOLT TRANSFORMER S17055.
28-1. REMOVE JUMPER BETWEEN POINTS (Y) AND (Z) & ADD JUMPER BETWEEN POINTS (X) AND (Z).

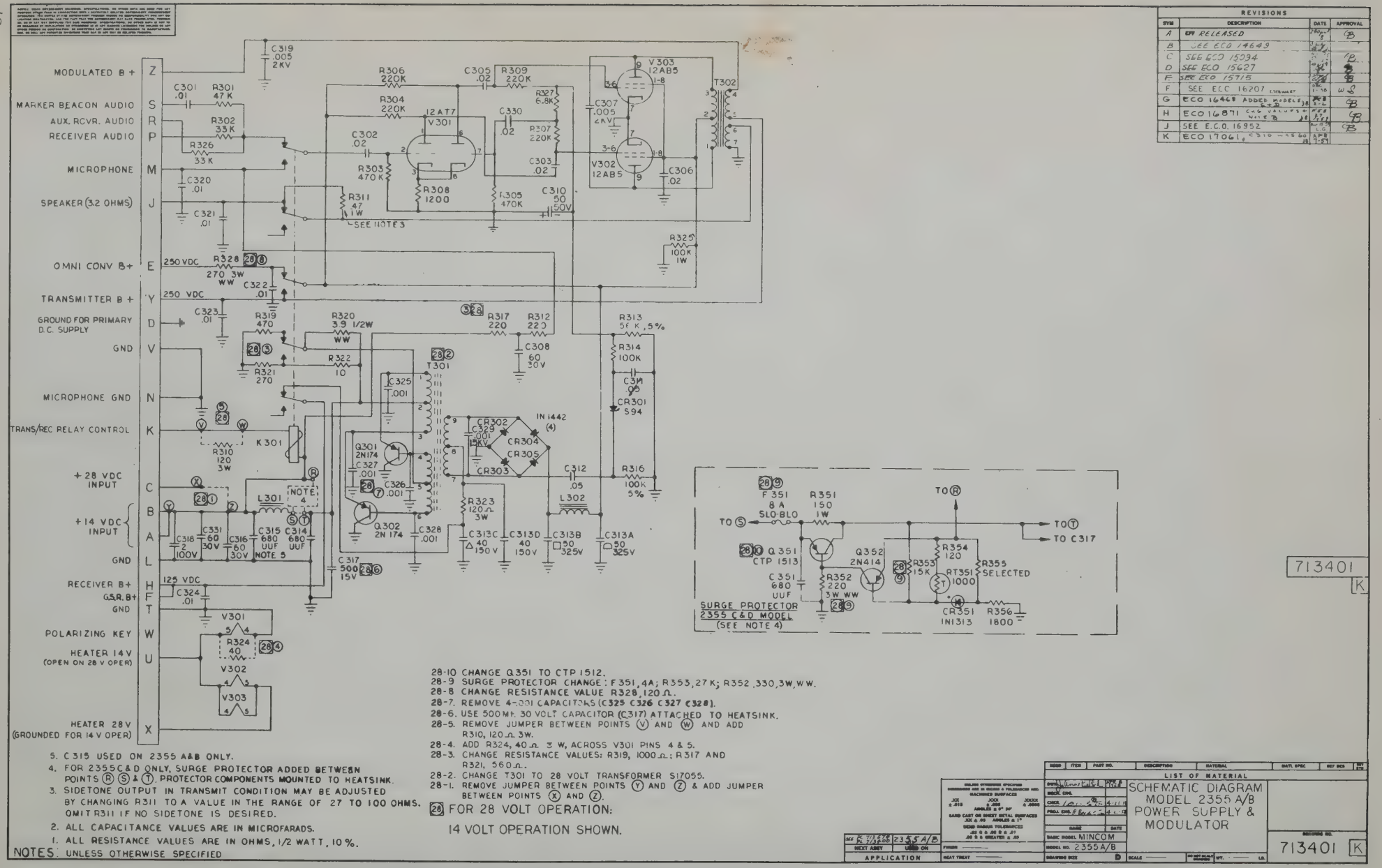
[28] FOR 28 VOLT OPERATION:

14 VOLT OPERATION SHOWN.

5. C 315 USED ON 2355 A&B ONLY.
4. FOR 2355 C&D ONLY, SURGE PROTECTOR ADDED BETWEEN POINTS (R) (S) & (T). PROTECTOR COMPONENTS MOUNTED TO HEATSINK.
3. SIDETONE OUTPUT IN TRANSMIT CONDITION MAY BE ADJUSTED BY CHANGING R311 TO A VALUE IN THE RANGE OF 27 TO 100 OHMS.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED

MODEL ~~FAB'T. NO.~~ 2355A,B,C,D	713401
USED ON: LNC-100	REV G



5. C 315 USED ON 2355 A&B ONLY.
4. FOR 2355 C & D ONLY, SURGE PROTECTOR ADDED BETWEEN POINTS Ⓡ Ⓢ & Ⓣ. PROTECTOR COMPONENTS MOUNTED TO HEATSINK.
3. SIDETONE OUTPUT IN TRANSMIT CONDITION MAY BE ADJUSTED BY CHANGING R311 TO A VALUE IN THE RANGE OF 27 TO 100 OHMS. OMIT R311 IF NO SIDETONE IS DESIRED.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.

NOTES: UNLESS OTHERWISE SPECIFIED

28-10 CHANGE Q 351 TO CTP 1512.
28-9 SURGE PROTECTOR CHANGE: F 351, 4A; R353, 27 K; R352, 330, 3W, WW.
28-8 CHANGE RESISTANCE VALUE R328, 120 Ω.
28-7. REMOVE 4-.001 CAPACITORS (C325 C326 C327 C328).
28-6. USE 500 MF. 30 VOLT CAPACITOR (C317) ATTACHED TO HEATSINK.
28-5. REMOVE JUMPER BETWEEN POINTS (V) AND (W) AND ADD R310, 120 Ω 3W.
28-4. ADD R324, 40 Ω 3 W, ACROSS V301 PINS 4 & 5.
28-3. CHANGE RESISTANCE VALUES: R319, 1000 Ω; R317 AND R321, 560 Ω.
28-2. CHANGE T301 TO 28 VOLT TRANSFORMER S17055.
28-1. REMOVE JUMPER BETWEEN POINTS (Y) AND (Z) & ADD JUMPER BETWEEN POINTS (X) AND (Z).

[28] FOR 28 VOLT OPERATION:

14 VOLT OPERATION SHOWN.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EPF RELEASED	2-8-61	CB
B	SEE ECO 14643	7-21-61	
C	SEE ECO 15094	10-31-61	CB
D	SEE ECO 15627	10-31-62	CB
F	SEE ECO 15715	2-28-63	CB
F	SEE ECO 16207 L.T.R. SHEET	11-30-63	WS
G	ECO 16468 ADDED MODELS C & D	3-2-64	CB
H	ECO 16871 CHG VALUES & NOTE B	6-22-64	CB
J	SEE E.C.O. 16952	8-17-64	CB
K	ECO 17061, C315 CHG TO 680 UF	1-6-65	CB

713401 K

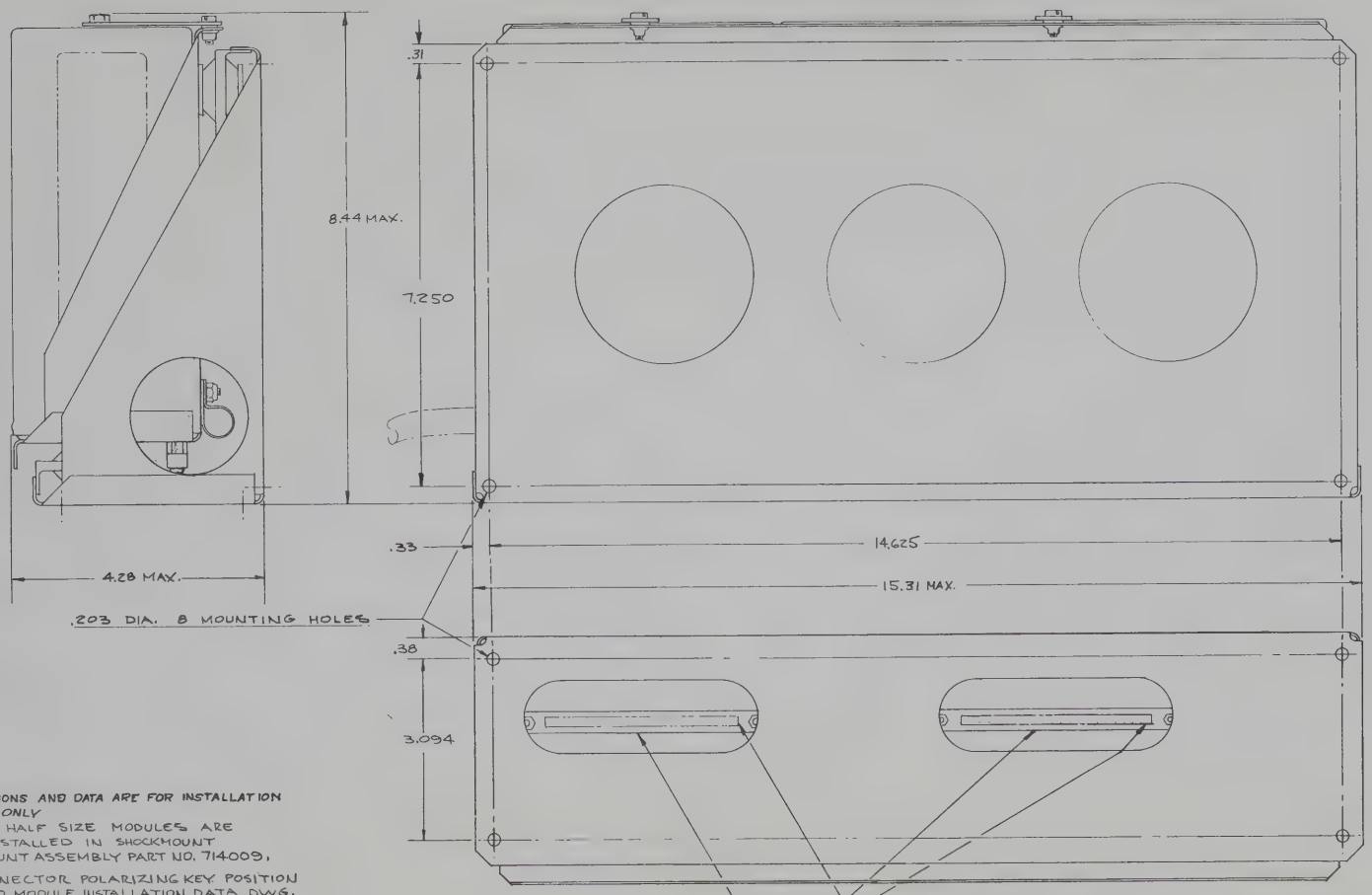
ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	QTY
		LIST OF MATERIAL				

DRWN			SCHEMATIC DIAGRAM MODEL 2355 A/B POWER SUPPLY & MODULATOR
DESIGN ENG.			
CHKR			
PROJ. ENG.			
BASIC MODEL	MINCOM		
MODEL NO.	2355 A/B		
DRAWING SIZE	D	SCALE	DRAWING NO. 713401 K

NEXT ASSY	USED ON	
APPLICATION		

NOTICE: UNLESS OTHERWISE OBLIGATED, SPECIFICATIONS, OR OTHER DATA ARE ISSUED FOR ART WORK A STATE THAT IS CONTRACTOR WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE UNITED STATES GOVERNMENT PROVIDES NO REIMBURSABILITY FOR ANY DISCLOSURE WHATSOEVER, AND THE FACT THAT THE GOVERNMENT MAY HAVE FURNISHED THE SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE, OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	22 JUNE 59	CB
B	SEE ECO 15864: SPACER WAS 534000-04	6-21-59	CB
C	ECO 16058 ADDED OR EQUIV TO CONNECT REQ'D	NOV 29 '59	CB
D	ECO 18320 CORRECT SPACER	OCT 13 1961	CB
E	ECO 19736 CHG CONNECTOR	AUG 9-60	MM



7 ALL DIMENSIONS AND DATA ARE FOR INSTALLATION PURPOSES ONLY

6. FULL AND HALF SIZE MODULES ARE SHOWN INSTALLED IN SHOCKMOUNT

5. SHOCKMOUNT ASSEMBLY PART NO. 714009.

4 FOR CONNECTOR POLARIZING KEY POSITION REFER TO MODULE INSTALLATION DATA DWG.

3. CABLE TO BE FREE OF CLAMPS OR RUBBING AGAINST OTHER OBJECTS FOR A MINIMUM OF 8 INCHES IN ORDER TO NOT AFFECT SHOCKMOUNT CHARACTERISTICS.

2. CABLE HARNESS MAY EMERGE FROM EITHER END THRU CLEARANCE HOLES, CABLE CLAMP IS PROVIDED WITH SHOCKMOUNT.

1. MOUNTING MAY BE IN VERTICAL POSITION AS SHOWN OR IN HORIZONTAL POSITION.

NOTES:

M'T'G HARDWARE:
AN 505-4-12 SCREW 4 REQ'D
534000-32 SPACER 4 REQ'D
AN 365-440 NUT 4 REQ'D

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES

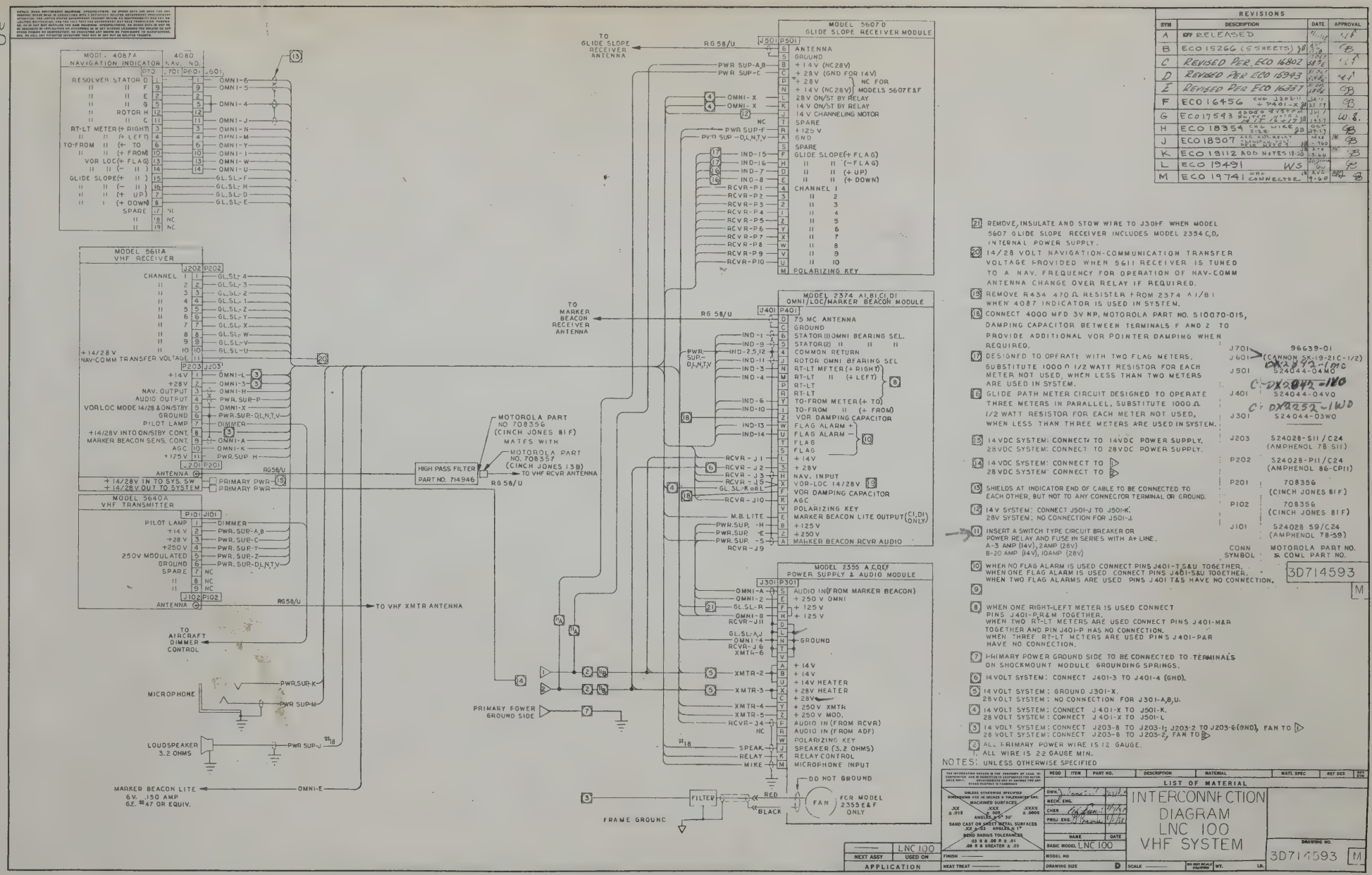
LIST OF MATERIAL

DWN. W Stefan	6-28-59	INSTALLATION DATA- LNC 100 SHOCKM'T 1½ SIZE MODULE
MECH. ENG.		
CHK. CB	30 June 59	
PROJ. ENG. W Stefan	6-29-59	
BASIC MODEL LNC 100		DRAWING NO. 714055 E
MODEL NO.		
DRAWING SIZE D	SCALE 1:1	DO NOT SCALE DRAWING WT. LB.

NEXT ASSY | USED ON
APPLICATION

714055
E

29



REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	ENG RELEASED	7/1/59	WS
B	ECO 15266 (5 SHEETS)	7/1/59	PB
C	REVISED PER ECO 16802	10/5/59	WS
D	REVISED PER ECO 15943	11/20/59	WS
E	REVISED PER ECO 16337	12/28/59	PB
F	ECO 16456 CHG J302-11 TO P401-X, J301-T TO P501-S	1/4/60	PB
G	ECO 017543 ADDED SYSTEM 14/28 VOLT OPTION, CHG J203-8 TO J203-6	1/11/60	W.S.
H	ECO 18354 CHG WIRE SIZE #8 TO #12	3/8/60	PB
J	ECO 18307 ADD ANTI-RELAY CHATTER DIODE	4/18/60	PB
K	ECO 18112 ADD NOTES 18-20	5/24/60	PB
L	ECO 19491 WS	6/6/60	PB
M	ECO 19741 CHG CONNECTOR	8/8/60	PB

21 REMOVE, INSULATE AND STOW WIRE TO J301-F WHEN MODEL 5607 GLIDE SLOPE RECEIVER INCLUDES MODEL 2354 C,D, INTERNAL POWER SUPPLY.

20 14/28 VOLT NAVIGATION-COMMUNICATION TRANSFER VOLTAGE PROVIDED WHEN 5611 RECEIVER IS TUNED TO A NAV. FREQUENCY FOR OPERATION OF NAV-COMM ANTENNA CHANGE OVER RELAY IF REQUIRED.

19 REMOVE R434 470 Ω RESISTER FROM 2374 A1/B1 WHEN 4087 INDICATOR IS USED IN SYSTEM.

18 CONNECT 4000 MFD 3V NP, MOTOROLA PART NO. 510070-015, DAMPING CAPACITOR BETWEEN TERMINALS F AND Z TO PROVIDE ADDITIONAL VOR POINTER DAMPING WHEN REQUIRED.

17 DESIGNED TO OPERATE WITH TWO FLAG METERS. SUBSTITUTE 1000 Ω 1/2 WATT RESISTOR FOR EACH METER NOT USED, WHEN LESS THAN TWO METERS ARE USED IN SYSTEM.

16 GLIDE PATH METER CIRCUIT DESIGNED TO OPERATE THREE METERS IN PARALLEL, SUBSTITUTE 1000 Ω 1/2 WATT RESISTOR FOR EACH METER NOT USED, WHEN LESS THAN THREE METERS ARE USED IN SYSTEM.

15 14 VDC SYSTEM: CONNECT TO 14VDC POWER SUPPLY. 28VDC SYSTEM: CONNECT TO 28VDC POWER SUPPLY.

14 14 VDC SYSTEM: CONNECT TO ▷
28 VDC SYSTEM: CONNECT TO ▷

13 SHIELDS AT INDICATOR END OF CABLE TO BE CONNECTED TO EACH OTHER, BUT NOT TO ANY CONNECTOR TERMINAL OR GROUND.

12 14V SYSTEM: CONNECT J501-J TO J501-K.
28V SYSTEM: NO CONNECTION FOR J501-J.

11 INSERT A SWITCH TYPE CIRCUIT BREAKER OR POWER RELAY AND FUSE IN SERIES WITH A+ LINE.
A-3 AMP (14V), 2AMP (28V)
B-20 AMP (14V), 10AMP (28V)

10 WHEN NO FLAG ALARM IS USED CONNECT PINS J401-T,S&U TOGETHER.
WHEN ONE FLAG ALARM IS USED CONNECT PINS J401-S&U TOGETHER.
WHEN TWO FLAG ALARMS ARE USED PINS J401 T&S HAVE NO CONNECTION.

9

8 WHEN ONE RIGHT-LEFT METER IS USED CONNECT PINS J401-P,R&M TOGETHER.
WHEN TWO RT-LT METERS ARE USED CONNECT PINS J401-M&R TOGETHER AND PIN J401-P HAS NO CONNECTION.
WHEN THREE RT-LT METERS ARE USED PINS J401-P&R HAVE NO CONNECTION.

7 PRIMARY POWER GROUND SIDE TO BE CONNECTED TO TERMINALS ON SHOCKMOUNT MODULE GROUNDING SPRINGS.

6 14 VOLT SYSTEM: CONNECT J401-3 TO J401-4 (GND).

5 14 VOLT SYSTEM: GROUND J301-X.
28 VOLT SYSTEM: NO CONNECTION FOR J301-A,B,U.

4 14 VOLT SYSTEM: CONNECT J401-X TO J501-K.
28 VOLT SYSTEM: CONNECT J401-X TO J501-L

3 14 VOLT SYSTEM: CONNECT J203-8 TO J203-1; J203-2 TO J203-6(GND), FAN TO ▷
28 VOLT SYSTEM: CONNECT J203-8 TO J203-2, FAN TO ▷

2 ALL PRIMARY POWER WIRE IS 12 GAUGE.

1 ALL WIRE IS 22 GAUGE MIN.

NOTES: UNLESS OTHERWISE SPECIFIED

CONN SYMBOL	MOTOROLA PART NO. & COML PART NO.
J701	96639-01
J601	(CANNON SK-19-21C-1/2) DX2813-1M0
J501	S24044-04W0 C-DX2804-1W0
J401	S24044-04V0 C-DX2852-1W0
J301	S24044-03W0
J203	S24028-S11/C24 (AMPHENOL 78 S11)
P202	S24028-P11/C24 (AMPHENOL 86-CP11)
P201	708356 (CINCH JONES 81F)
P102	708356 (CINCH JONES 81F)
J101	S24028 S9/C24 (AMPHENOL 78-S9)

3D714593 M

NEXT ASSY	USED ON
APPLICATION	LNC 100

LIST OF MATERIAL

DWN.	DATE
RECH. ENG.	
CHKR	8/8/60
PROJ. ENG.	8/8/60

NAME DATE

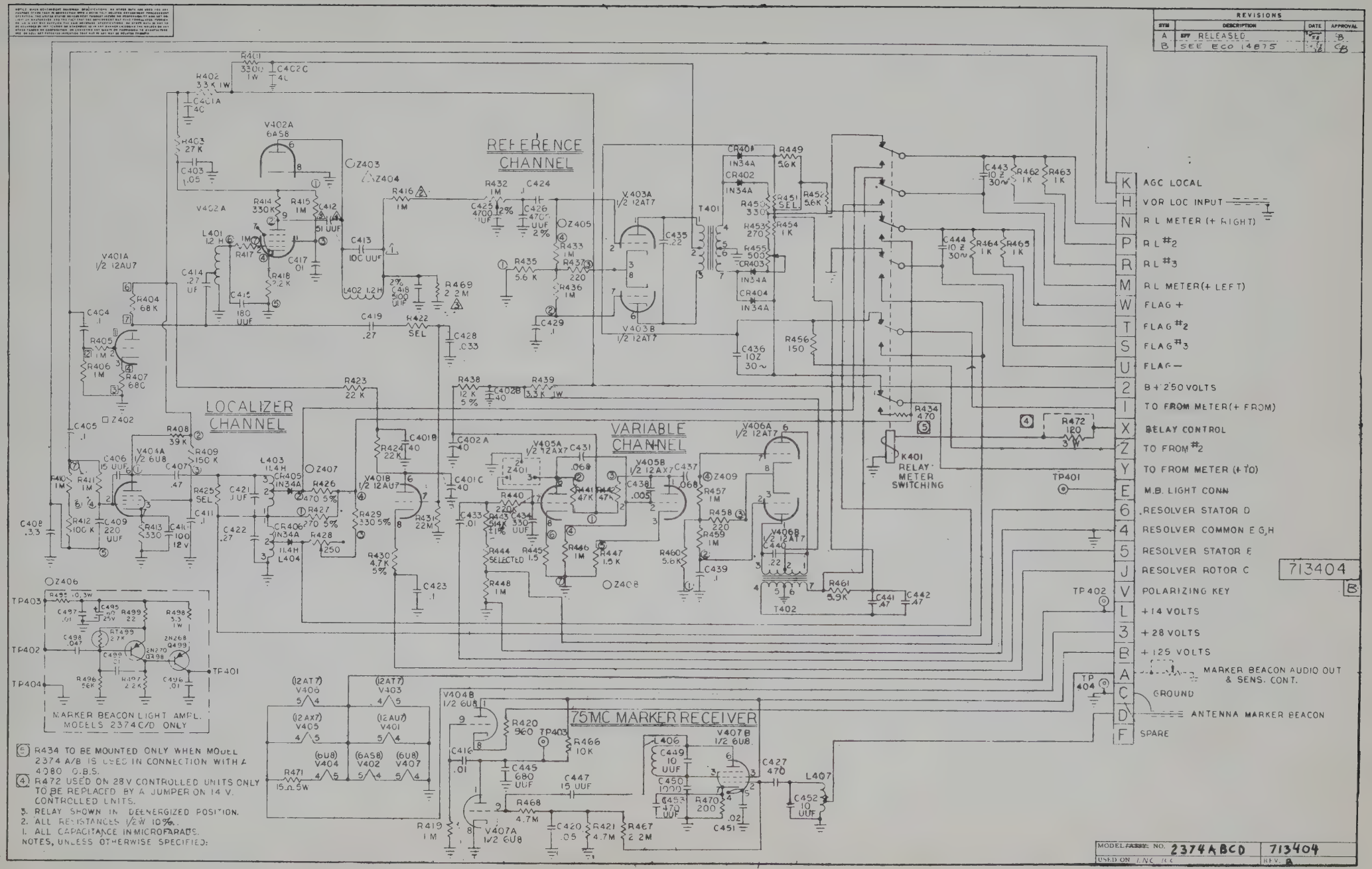
BASIC MODEL LNC 100

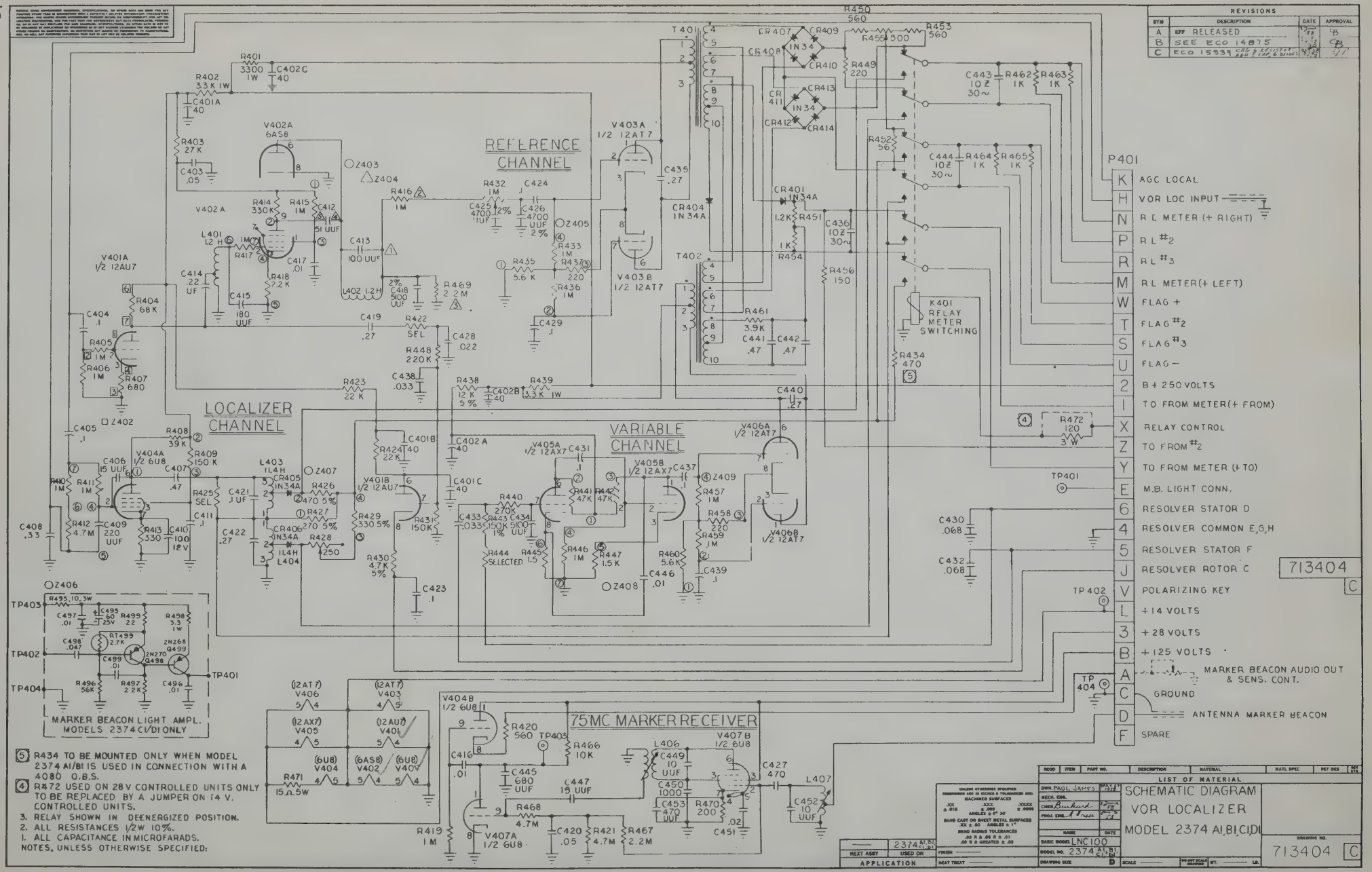
MODEL NO

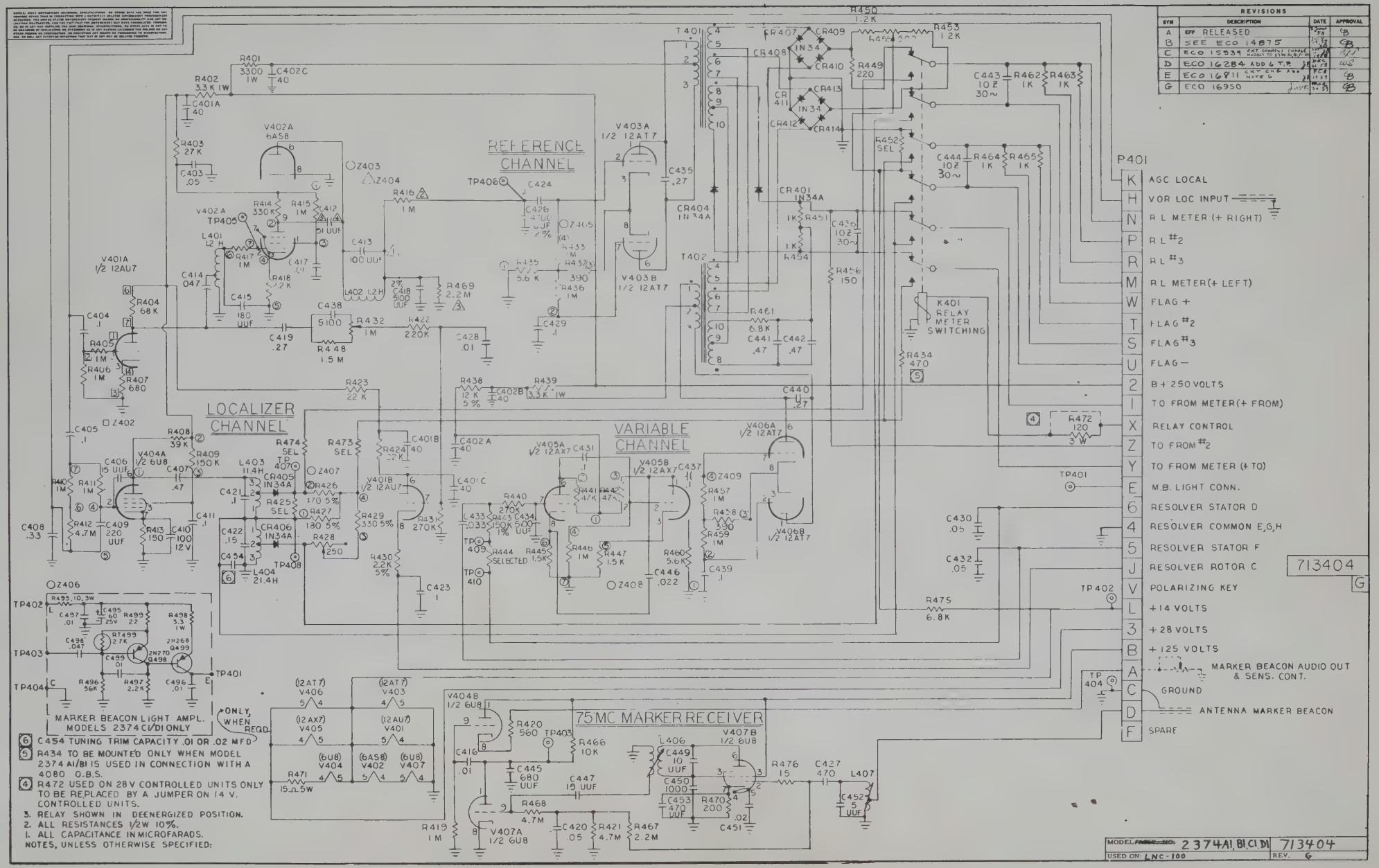
DRAWING SIZE D SCALE

INTERCONNECTION DIAGRAM LNC 100 VHF SYSTEM

DRAWING NO. 3D714593 M


REVISIONS
SYM | DESCRIPTION | DATE | APPROVAL
A | EFF RELEASED | 5B
B | SEE ECO 14875 | 5B
REFERENCE CHANNEL
LOCALIZER CHANNEL
VARIABLE CHANNEL
75MC MARKER RECEIVER
K401 RELAY METER SWITCHING
MARKER BEACON LIGHT AMPL. MODELS 2374C/D ONLY
K AGC LOCAL
H VOR LOC INPUT
N R L METER (+ RIGHT)
P R L #2
R R L #3
M R L METER(+ LEFT)
W FLAG +
T FLAG #2
S FLAG #3
U FLAG —
2 B+ 250 VOLTS
I TO FROM METER(+ FROM)
X RELAY CONTROL
Z TO FROM #2
Y TO FROM METER (+ TO)
E M.B. LIGHT CONN
6 RESOLVER STATOR D
4 RESOLVER COMMON E,G,H
5 RESOLVER STATOR E
J RESOLVER ROTOR C
V POLARIZING KEY
L +14 VOLTS
3 +28 VOLTS
B +125 VOLTS
A MARKER BEACON AUDIO OUT & SENS. CONT.
C GROUND
D ANTENNA MARKER BEACON
F SPARE
713404
B
(5) R434 TO BE MOUNTED ONLY WHEN MODEL 2374 A/B IS USED IN CONNECTION WITH A 4080 O.B.S.
(4) R472 USED ON 28V CONTROLLED UNITS ONLY TO BE REPLACED BY A JUMPER ON 14 V. CONTROLLED UNITS.
3. RELAY SHOWN IN DEENERGIZED POSITION.
2. ALL RESISTANCES 1/2W 10%.
1. ALL CAPACITANCE IN MICROFARADS.
NOTES, UNLESS OTHERWISE SPECIFIED:
MODEL NO. 2374ABCD
713404
USED ON L.N.C. REV. B


REFERENCE CHANNEL
LOCALIZER CHANNEL
VARIABLE CHANNEL
75MC MARKER RECEIVER
MARKER BEACON LIGHT AMPL. MODELS 2374 CI/DI ONLY
K401 RELAY METER SWITCHING
P401
AGC LOCAL
VOR LOC INPUT
R L METER (+ RIGHT)
R L #2
R L #3
R L METER(+ LEFT)
FLAG +
FLAG #2
FLAG #3
FLAG −
B+ 250 VOLTS
TO FROM METER(+ FROM)
RELAY CONTROL
TO FROM #2
TO FROM METER (+ TO)
M.B. LIGHT CONN.
RESOLVER STATOR D
RESOLVER COMMON E,G,H
RESOLVER STATOR F
RESOLVER ROTOR C
POLARIZING KEY
+14 VOLTS
+28 VOLTS
+125 VOLTS
MARKER BEACON AUDIO OUT & SENS. CONT.
GROUND
ANTENNA MARKER BEACON
SPARE
713404 C
5 R434 TO BE MOUNTED ONLY WHEN MODEL 2374 AI/BI IS USED IN CONNECTION WITH A 4080 O.B.S.
4 R472 USED ON 28 V CONTROLLED UNITS ONLY TO BE REPLACED BY A JUMPER ON 14 V. CONTROLLED UNITS.
3. RELAY SHOWN IN DEENERGIZED POSITION.
2. ALL RESISTANCES 1/2W 10%.
1. ALL CAPACITANCE IN MICROFARADS.
NOTES, UNLESS OTHERWISE SPECIFIED:
REVISIONS
A ECP RELEASED
B SEE ECO 14875
C ECO 15939
LIST OF MATERIAL
SCHEMATIC DIAGRAM VOR LOCALIZER MODEL 2374 AI,BI,CI,DI
DRAWN PAUL JAMES
BASIC MODEL LNC100
MODEL NO. 2374 AI,BI CI,DI
DRAWING NO. 713404 C
NEXT ASSY USED ON 2374 AI,BI
APPLICATION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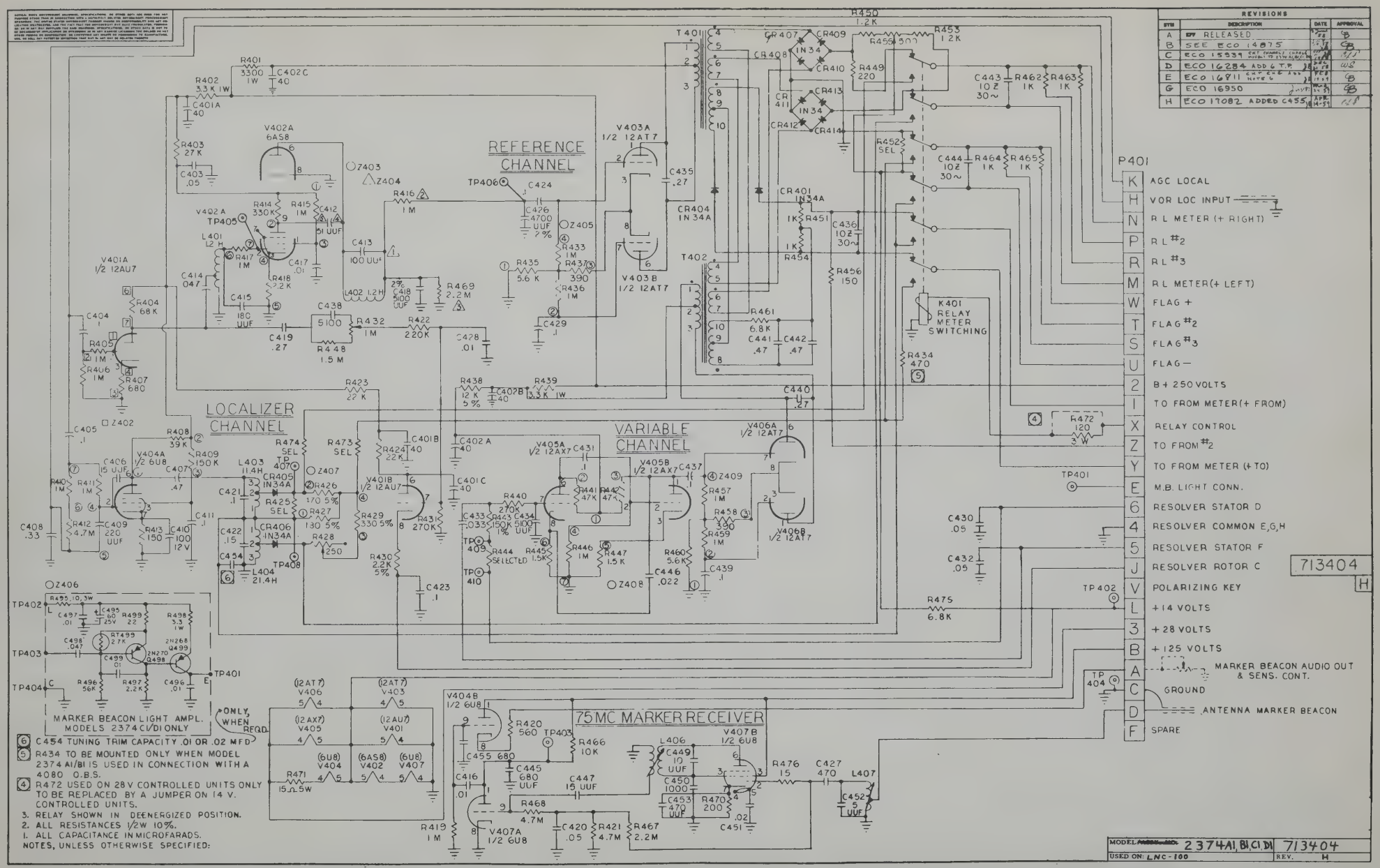
LOCALIZER CHANNEL
VARIABLE CHANNEL
75MC MARKER RECEIVER
K401 RELAY METER SWITCHING
P401
K AGC LOCAL
H VOR LOC INPUT
N R L METER (+ RIGHT)
P R L #2
R R L #3
M R L METER(+ LEFT)
W FLAG +
T FLAG #2
S FLAG #3
U FLAG —
2 B+ 250 VOLTS
I TO FROM METER(+ FROM)
X RELAY CONTROL
Z TO FROM #2
Y TO FROM METER (+ TO)
E M.B. LIGHT CONN.
6 RESOLVER STATOR D
4 RESOLVER COMMON E,G,H
5 RESOLVER STATOR F
J RESOLVER ROTOR C
V POLARIZING KEY
L +14 VOLTS
3 +28 VOLTS
B +125 VOLTS
A MARKER BEACON AUDIO OUT & SENS. CONT.
C GROUND
D ANTENNA MARKER BEACON
F SPARE
713404 G
MARKER BEACON LIGHT AMPL. MODELS 2374 CI/DI ONLY
ONLY, WHEN REQD
6 C454 TUNING TRIM CAPACITY .01 OR .02 MFD
5 R434 TO BE MOUNTED ONLY WHEN MODEL 2374 AI/BI IS USED IN CONNECTION WITH A 4080 O.B.S.
4 R472 USED ON 28V CONTROLLED UNITS ONLY TO BE REPLACED BY A JUMPER ON 14 V. CONTROLLED UNITS.
3. RELAY SHOWN IN DEENERGIZED POSITION.
2. ALL RESISTANCES 1/2W 10%.
1. ALL CAPACITANCE IN MICROFARADS.
NOTES, UNLESS OTHERWISE SPECIFIED:
MODEL FROM NO. 2374A1, B1, C1, D1 713404
USED ON: LNC-100 REV. G

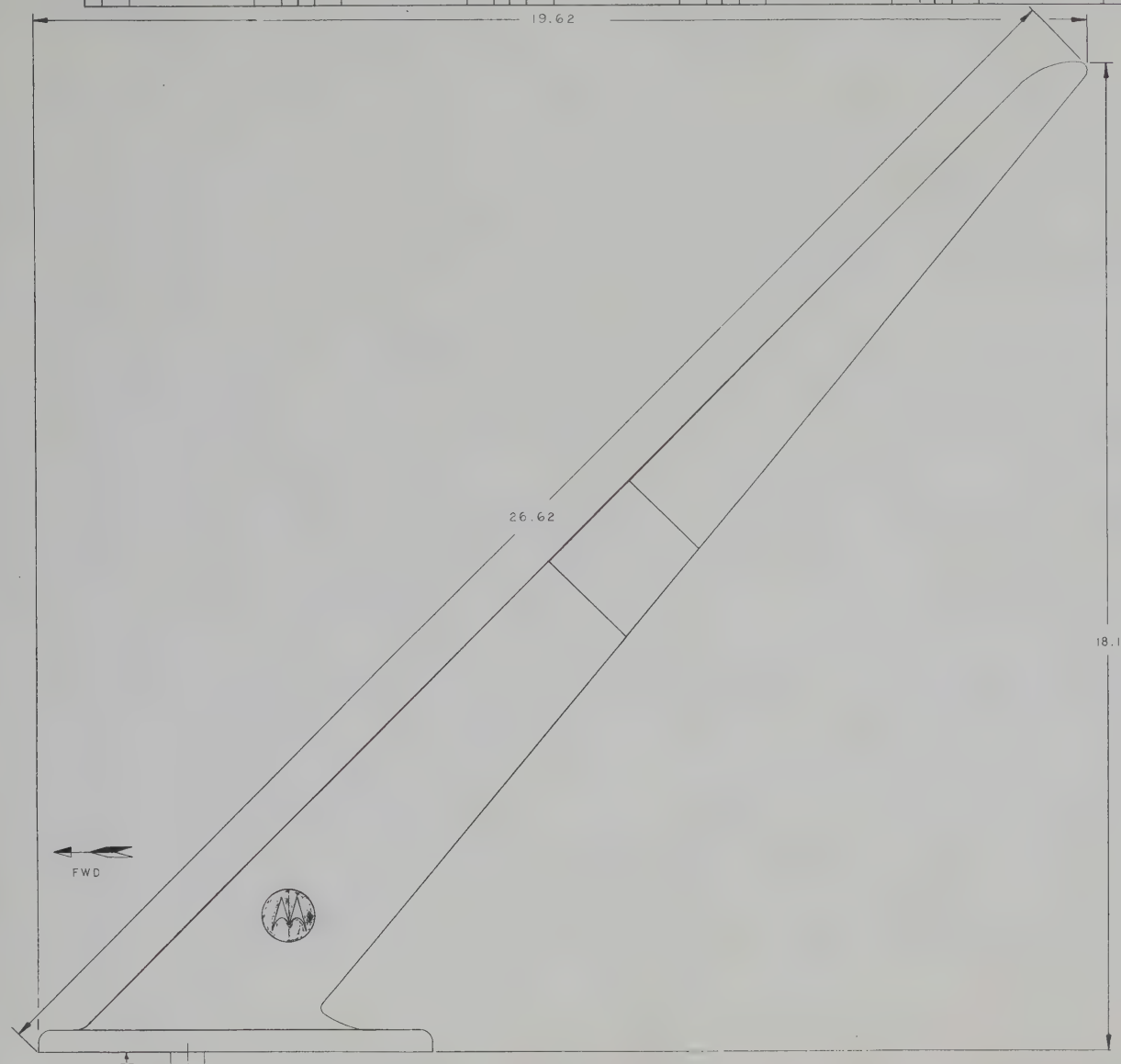
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	3-[illegible]-58	GB
B	SEE ECO 14875	3-19-59	GB
C	ECO 15539 CRT CHANGE, CHANGE MODEL TO 2374A,B,C,D	11-18-59	RJ
D	ECO 16284 ADD 6 T.P.	12-29-59	WB
E	ECO 16911 C.R.V. CHG. ADD NOTE 6	FEB 1960	GB
G	ECO 16950	MAR 8 1960	GB

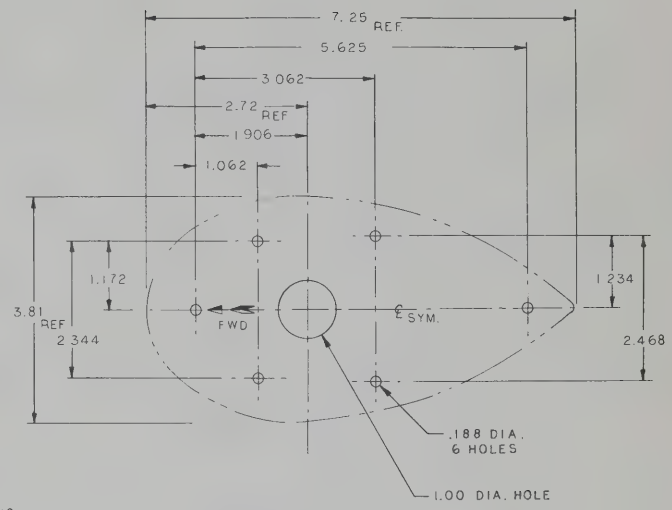

REFERENCE CHANNEL
LOCALIZER CHANNEL
VARIABLE CHANNEL
75MC MARKER RECEIVER
MARKER BEACON LIGHT AMPL. MODELS 2374 CI/DI ONLY
P401
K AGC LOCAL
H VOR LOC INPUT
N R L METER (+ RIGHT)
P R L #2
R R L #3
M R L METER(+ LEFT)
W FLAG +
T FLAG #2
S FLAG #3
U FLAG —
2 B+ 250 VOLTS
I TO FROM METER(+ FROM)
X RELAY CONTROL
Z TO FROM #2
Y TO FROM METER (+ TO)
E M.B. LIGHT CONN.
6 RESOLVER STATOR D
4 RESOLVER COMMON E,G,H
5 RESOLVER STATOR F
J RESOLVER ROTOR C
V POLARIZING KEY
L +14 VOLTS
3 +28 VOLTS
B +125 VOLTS
A MARKER BEACON AUDIO OUT & SENS. CONT.
C GROUND
D ANTENNA MARKER BEACON
F SPARE
K401 RELAY METER SWITCHING
713404
H
6 C454 TUNING TRIM CAPACITY .01 OR .02 MFD
5 R434 TO BE MOUNTED ONLY WHEN MODEL 2374 AI/BI IS USED IN CONNECTION WITH A 4080 O.B.S.
4 R472 USED ON 28V CONTROLLED UNITS ONLY TO BE REPLACED BY A JUMPER ON 14 V. CONTROLLED UNITS.
3. RELAY SHOWN IN DEENERGIZED POSITION.
2. ALL RESISTANCES 1/2W 10%.
1. ALL CAPACITANCE IN MICROFARADS.
NOTES, UNLESS OTHERWISE SPECIFIED:

STN	DESCRIPTION	DATE	APPROVAL
A	RELEASED		
B	SEE ECO 14875		
C	ECO 15939		
D	ECO 16284 ADD 6 T.P.		
E	ECO 16811		
G	ECO 16950		
H	ECO 17082 ADDED C455		

MODEL 2374A1, B1, C1, D1 713404
USED ON: LNC-100 REV. H

ISSUE	CO NO	CHANGE	DATE	CHK
E	20066	REVISED & REDRAWN		





VIEW SHOWING
PATTERN OF
MOUNTING HOLES
FOR MATCHING PART

2217-1
E

3. DIMENSIONS SHOWN ARE FOR INSTALLATION PURPOSES ONLY.
2. CONNECTOR UG-21 B/U AND GASKET PART NO. 704039 SUPPLIED WITH ANTENNA
1. CABLE - 50 OHM COAXIAL

NOTES: UNLESS OTHERWISE SPECIFIED

PART NO	FINAL ASSY	MODEL	SYSTEM
—	1U714742	2217C	
—	1U712215	2217B	
—	1U700975	2217A	

QUANTITY REQUIRED	PART NO.	TITLE
DWN. BY J. Baker 8-15-60		LIST OF PARTS
CHECK [illegible] 8-15-60	MATERIAL	
M ENG	MATL. SPEC	
E ENG [illegible]	FINISH	
NAME	DATE	HEAT TREAT
		WEIGHT 1.9 LB SCALE 1/1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE .XX ±.015, .XXX .005, ANGLES ±1°

DO NOT SCALE DWG.

TITLE: INSTALLATION DATA, MODEL 2217 VHF BROADBAND ANTENNA

MOTOROLA INC. SANTA MONICA, CALIFORNIA

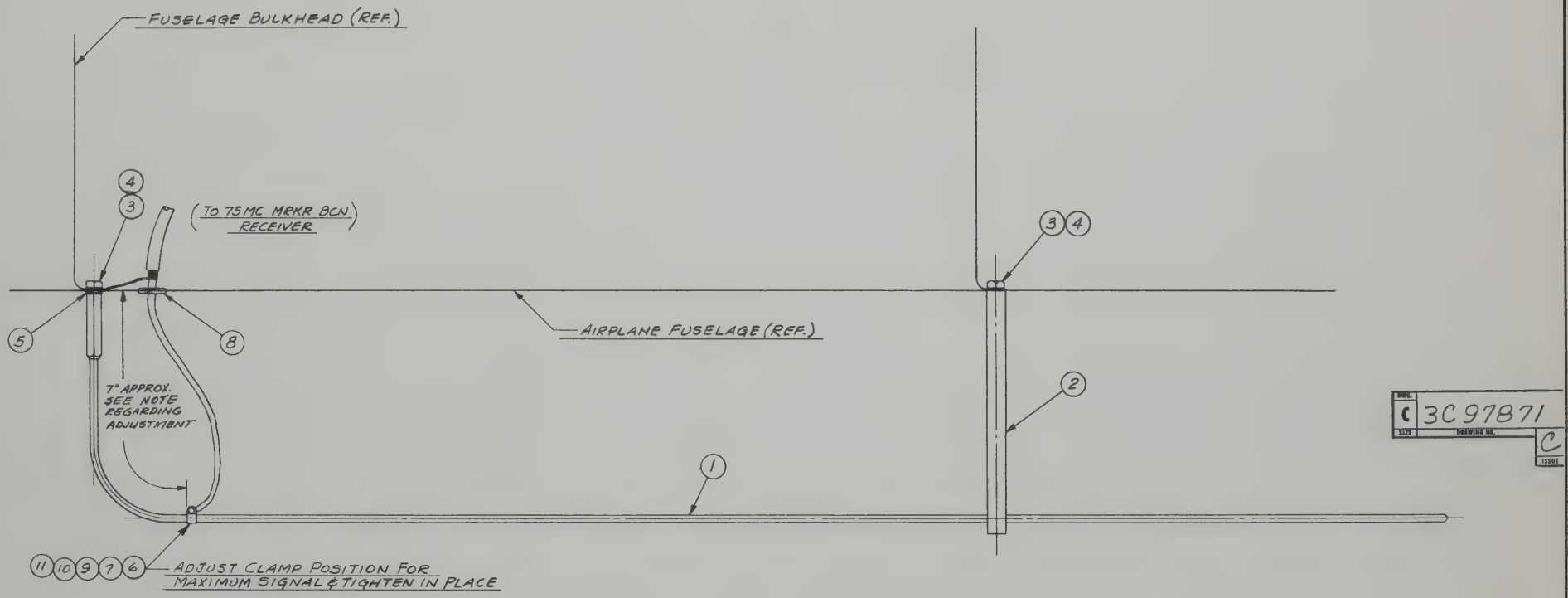
SIZE	DWG. NO.	ISSUE
D	2217-1	E

74427

17

ISSUE	CHANGE ORDER NO.	CHANGE	DATE BY	CHK.
A	—	Released	3/16/62	A.T.
B	6163	SEE E.C.O.	10/11/63	
C	19930	CHG DWG NO -ADD (2)	8-23-67	

FORWARD



DWG. C 3C97871
SIZE DRAWING NO. ISSUE C

ASSEMBLY NOTES:

1. DRILL 1/4 MTG. HOLES FOR ANTENNA AND SUPPORT THROUGH FUSELAGE SKIN AND BULKHEAD FLANGE FOR ADDED STRENGTH.

(2) SEE P.L. 2U97871 FOR QTY REQ'D

	ITEM	PART No.	REQ. (2)	DESCRIPTION
B	11	56197		WASHER – INT. TOOTH LOCK
B	10	AN961-6		WASHER – FLAT
B	9	13220		NUT, HEX BRASS #6-32
	8	4669		GROMMET - RUBBER
B	7	Q5523-06-06		SCREW, BRASS
	6	62497-05		CLAMP
B	5	AN961-416		WASHER – FLAT
	4	56200		WASHER – INT. TOOTH LOCK
	3	Q3513-25-12		SCREW
	2	97873		SUPPORT
	1	97872		WHIP ANTENNA

UNLESS OTHERWISE SPECIFIED
Dimensions apply after Plating and Heat Treating
C'Bore and Spotface Corner Radii .010 Max.
BREAK ALL EDGES .010
Dimensions are in inches and Tolerances are:
Decimals ± .005; Fractions ± 1/64; Angles ± ½°
Sheet Metal and Sand Casting Tolerances are:
Fractions ± 1/32; Angles ± 1°
SURFACE ROUGHNESS — RMS VALUE
SCALE 1:2 | DO NOT SCALE DRAWING

EXP. LABS.		
CHECKER		
CHIEF ENGR.		
STRESS		
MATERIALS		
SALES		
MFG.		
DEVELOPMENT		
PRODUCT	R. Steele	5/16/62
DESIGN		
DRAWN	J. Packos	11/16/62

PART NO.

© COMMERCIAL PART — SEE DETAIL DRAWING BEFORE ORDERING | WT. | LB. | PART REF. 2U97871 | BASIC MODEL

MATERIAL | HEAT TREAT

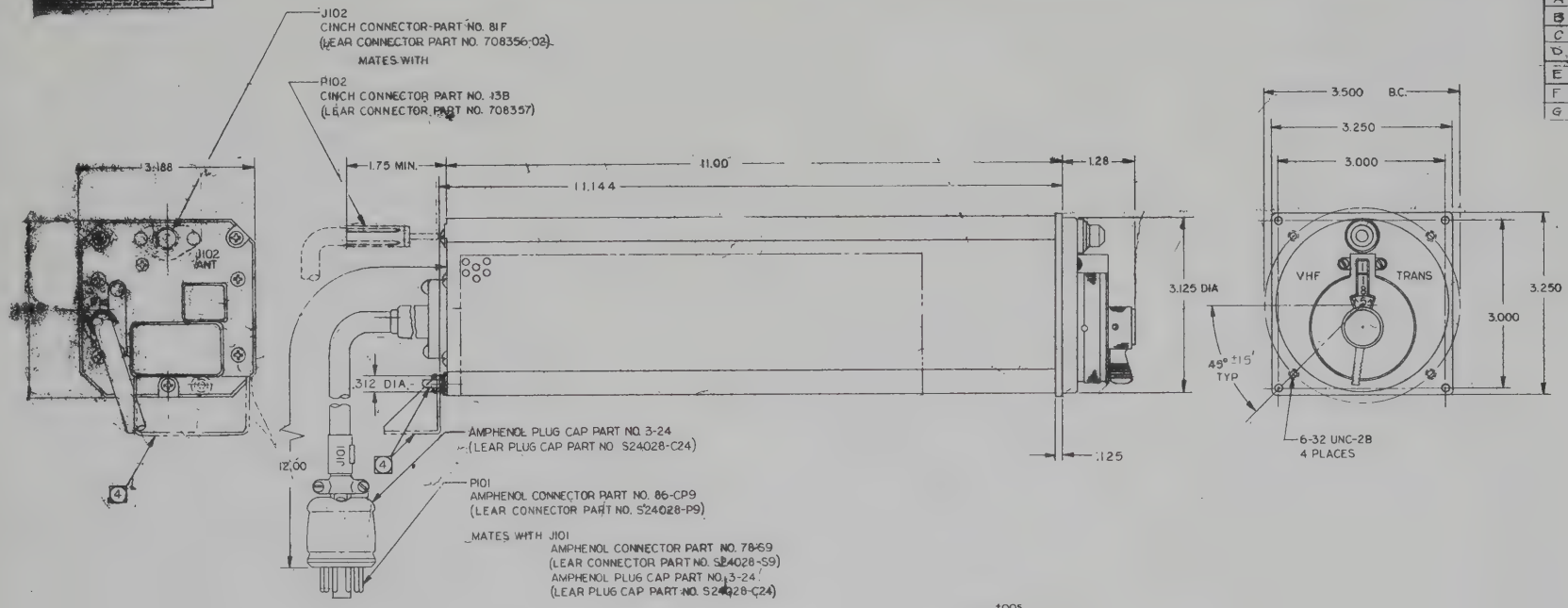
FINISH

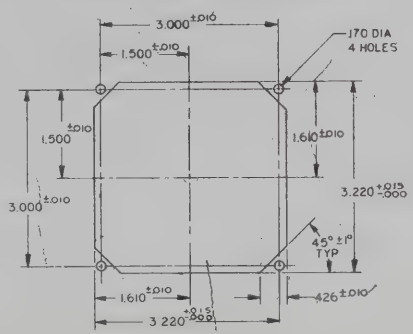
DRAWING TITLE: INSTALLATION-WHIP ANTENNA 75MC MRKR BCN

CATEGORY | DWG. C | SIZE | DRAWING NO. 3C97871

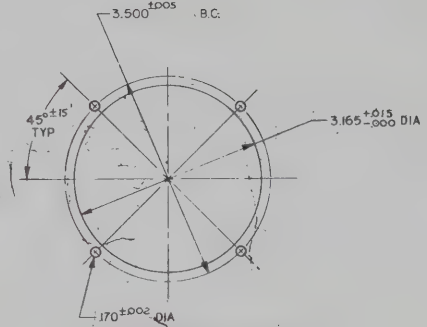
THOM... U. S. 1000H 1800 7-62

REVISIONS				
SYM	DESCRIPTION	DATE	APPROVAL	
A	RELEASED	AUG 58		GB
B	SEE ECO # 15039	AUG 58		GB
C	SEE ECO # 15520	13 OCT 59		GB
D	ECO 15740 ADD NOTE 4 & PHANTOM BRACKET	28 OCT 59		GB
E	ECO 16941 MOVE PHANTOM BRACKET	22 OCT 59		GB
F	ECO 17044 ADD NOTE 5	28 APR 60		GB
G	ECO 18439 CORRECT ANGLE TOL	9 NOV 60		GB





FRONT MOUNTING
PER MS33556



REAR MOUNTING
PER MS33550

5640-1
G

5. 14 VOLT PILOT LAMP SUPPLIED. FOR 28 VOLT OPERATION CHANGE LAMP TO 28 VOLT .17AMP (LEAR PART NO. 96575-103).

4. TO COMPLY WITH TSO C37 b (WHEN NOT INSTALLED IN SHOCK MOUNTED INSTRUMENT PANEL) A SUPPORT BRACKET, SHOWN BY PHANTOM LINES, .050 THK. 5052 H32 ALUM. SHALL BE MADE & INSTALLED. ORDER KIT NO. 714930 (DOES NOT INCLUDE BRACKET).

3. SCHEMATIC DIAGRAM NO. 713410.

2. FINAL ASSEMBLY NO. 713409.

1. DIMENSIONS, CALLOUTS, AND NOTES ARE FOR INSTALLATION PURPOSES ONLY.

NOTES:

INSTALLATION DATA
MODEL 5640 A
LNC 100 XMTR

LIST OF MATERIAL

ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REV DES

DWN Bill Ellmore 8-58
APPD Lindsey 8-58
CHKD Lindsey 8-58
ENGR 8-58
NAME PLATE LNC 100
MODEL NO

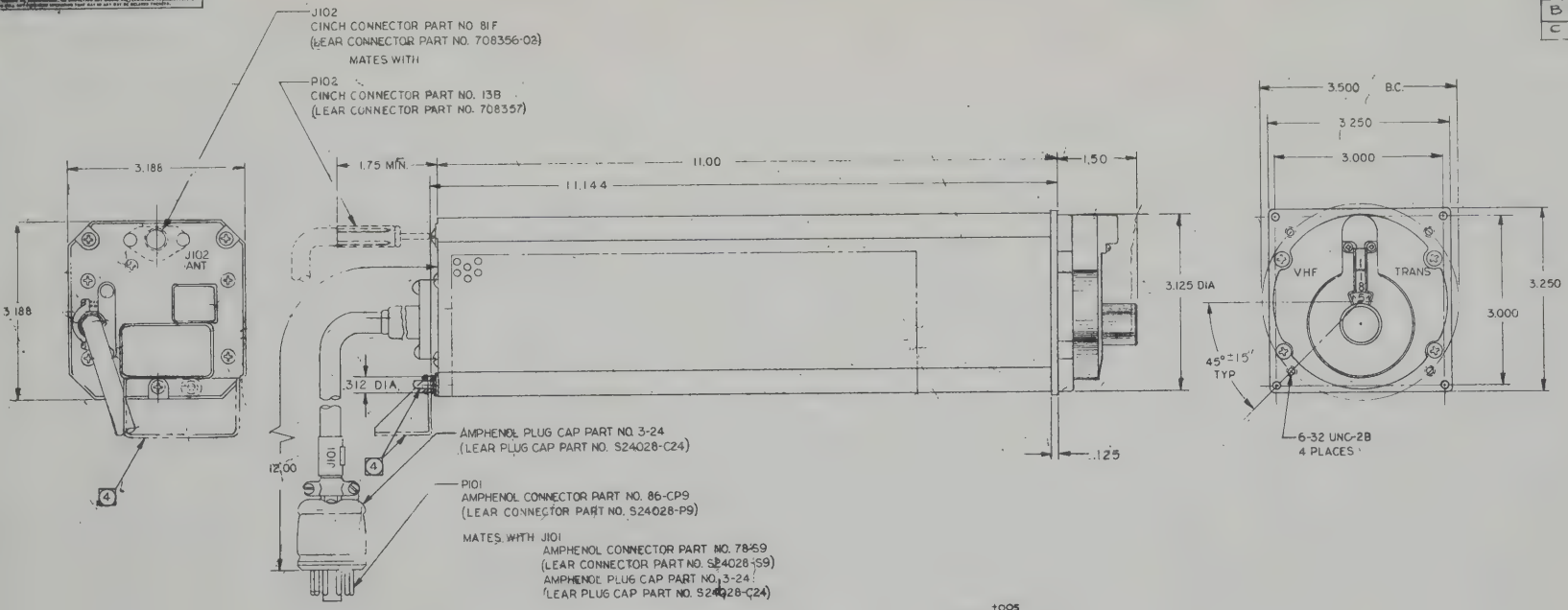
INSTALLATION DATA
MODEL 5640 A.
XMTR

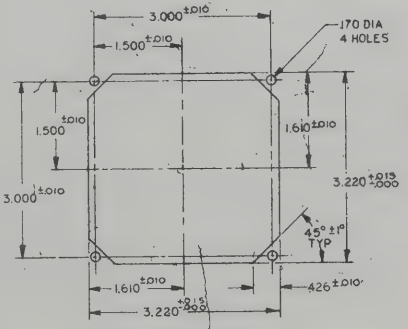
5640-1 G

APPLICATION 5640A

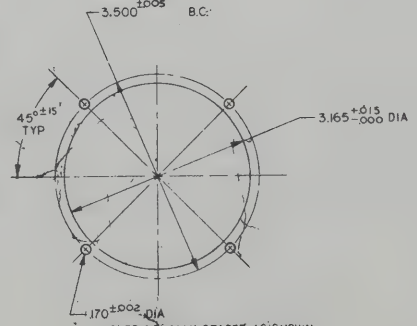
61

REVISIONS			
STM	DESCRIPTION	DATE	APPROVAL
A	ECP RELEASED	3 MAY 57	SB
B	ECO 17045 ADD NOTE 5	APR. 2-59	SB
C	ECO 18490 CORRECT ANGLE TOL	MAY 10/13/60	SB





FRONT MOUNTING
PER MS33556



REAR MOUNTING
PER MS33550

5. 14 VOLT PILOT LAMP SUPPLIED. FOR 28 VOLT OPERATION CHANGE LAMP TO 28 VOLT .17AMP (LEAR PART NO. 96575-103).

[4] TO COMPLY WITH TSO C37 b (WHEN NOT INSTALLED IN SHOCK MOUNTED INSTRUMENT PANEL) A SUPPORT BRACKET, SHOWN BY PHANTOM LINES, .050 THK. 5052 H32 ALUM. SHALL BE MADE & INSTALLED. ORDER KIT NO. 714930 (DOES NOT INCLUDE BRACKET).

3. SCHEMATIC DIAGRAM NO. 715224
2. FINAL ASSEMBLY NO 715223
1. DIMENSIONS, CALLOUTS, AND NOTES ARE FOR INSTALLATION PURPOSES ONLY.

NOTES:

5640-2
C

INSTALLATION DATA
MODEL 5640 A1
LNC 100 XMTR

FINAL	5640 A1						
NEXT ASSY	USED ON						
APPLICATION							

LIST OF MATERIAL

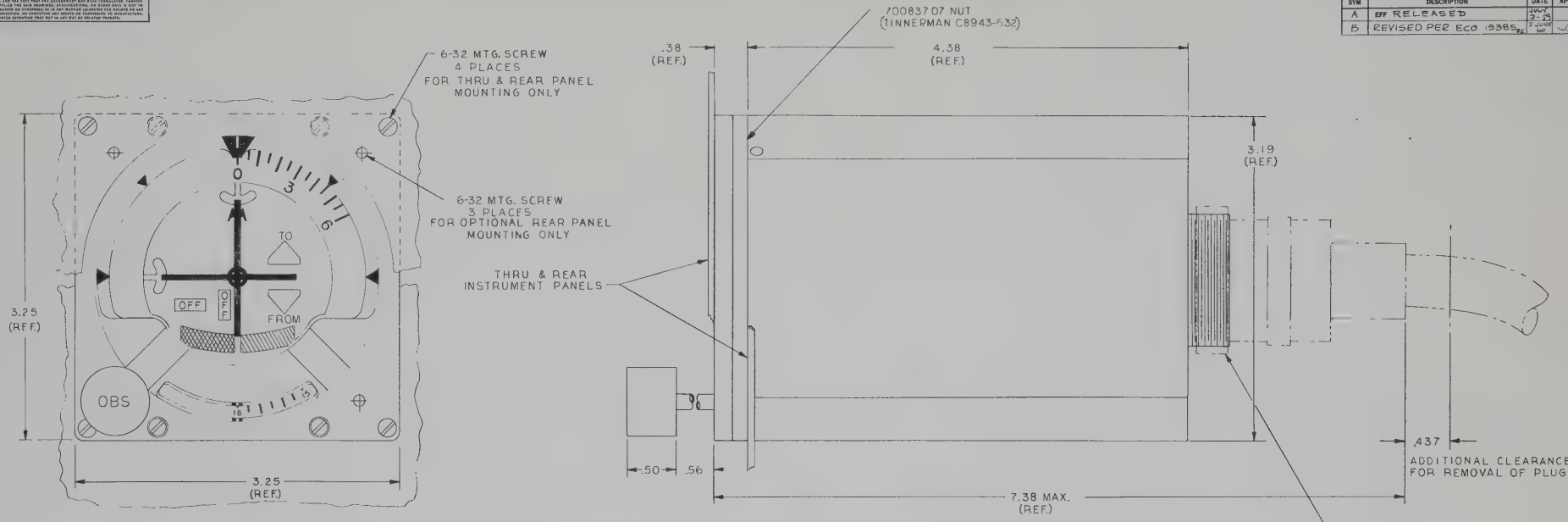
REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC
DWG Bill Engr					
MECH ENG					
CHECK Engineering					
PROJ ENGR					
NAME	DATE				
BASIC MODEL LNC 100					
SPECIAL 5640 A1					
SHEET SIZE D					

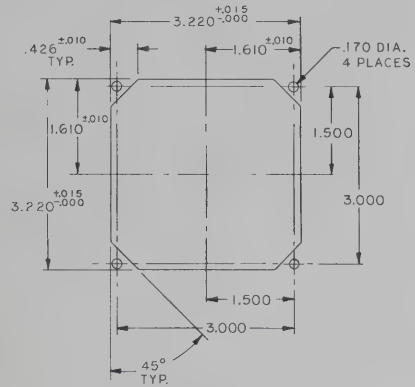
INSTALLATION DATA
MODEL 5640 A1
XMTR

DRAWING NO. 5640-2 C

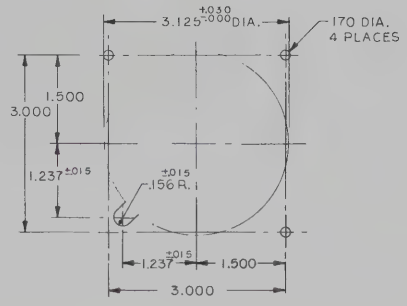
NOTICE: WHEN GOVERNMENT DRAWINGS, SPECIFICATIONS, OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE UNITED STATES GOVERNMENT THEREBY INCURS NO RESPONSIBILITY NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	1JUN57 2-19	W.S.
B	REVISED PER ECO 19385 RE	7 JUNE 60	JBH

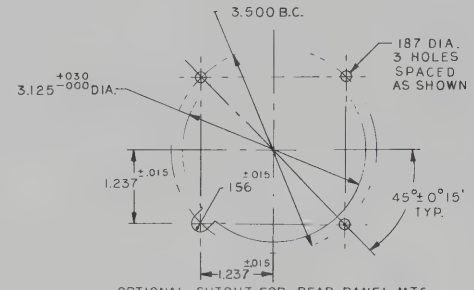




CUTOUT FOR THROUGH PANEL MTG.
SCALE: 1/1



CUTOUT FOR REAR PANEL MTG.
SCALE: 1/1



OPTIONAL CUTOUT FOR REAR PANEL MTG.
SCALE: 1/1

4087-2 B

3. FOR SCHEMATIC DIAGRAM SEE DWG. NO. 3C712234.
2. FOR FINAL ASSEMBLY SEE DWG. NO. 1U712278.
1. ALL DIMENSIONS ARE FOR INSTALLATION PURPOSES ONLY.

NOTES:

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	REV SYM

LIST OF MATERIAL

THE INFORMATION HEREIN IS THE PROPERTY OF LEAR, INCORPORATED, AND IS SUBMITTED IN CONFIDENCE FOR SITTED USE ONLY. IT IS NOT TO BE REPRODUCED OR USED FOR ANY OTHER PURPOSE IS FORBIDDEN

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES & TOLERANCED AS: MACHINED SURFACES .XX ±.010, .XXX ±.005, .XXXX ±.0005, ANGLES ± 0° 30' SAND CAST OR SHEET METAL SURFACES .XX ±.03 ANGLES ± 1° BEND RADIUS TOLERANCES .03 R & .06 R ± .01, .09 R & GREATER ± .03

	NAME	DATE
DWN	Jane Ball	1JUN60
MECH. ENG.		2-19
CHKR.		1JUN60
PROJ. ENG.		2-19

BASIC MODEL 4087
MODEL NO. 4087B
DRAWING SIZE D
SCALE 2/1 NOTED DO NOT SCALE DRAWING WT. 1.5 LB.

INSTALLATION DATA
COURSE SELECTOR
INDICATOR
MODEL 4087B

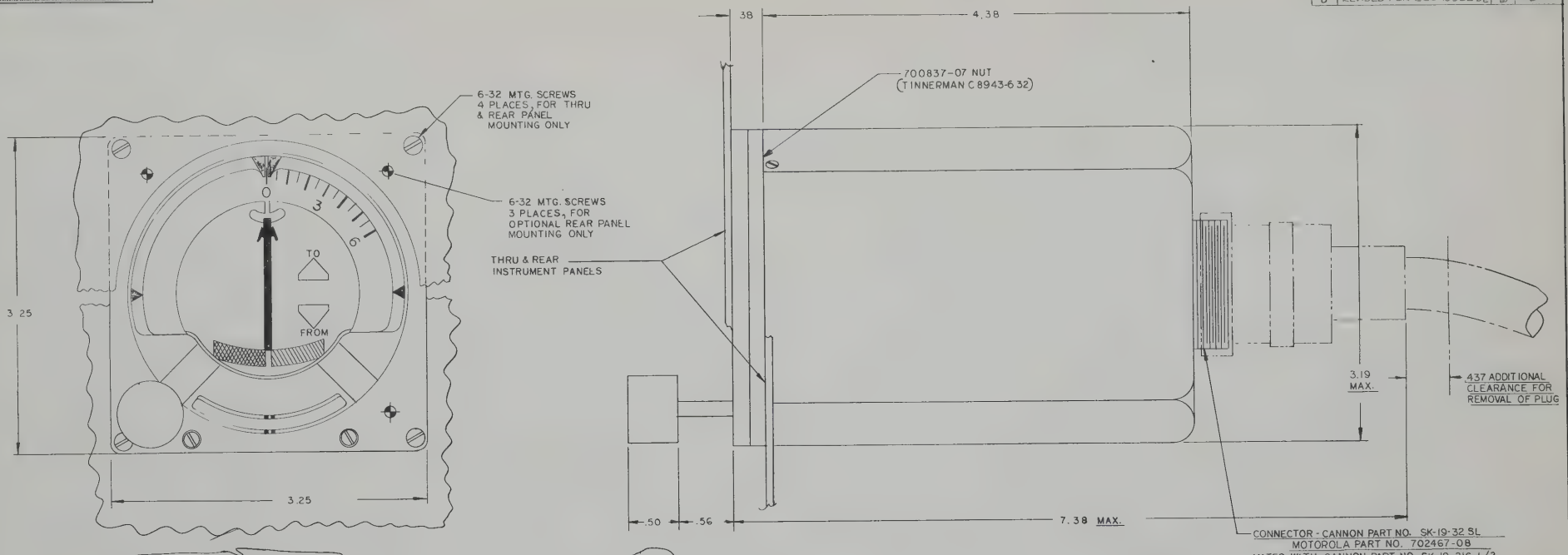
DRAWING NO. 4087-2 B

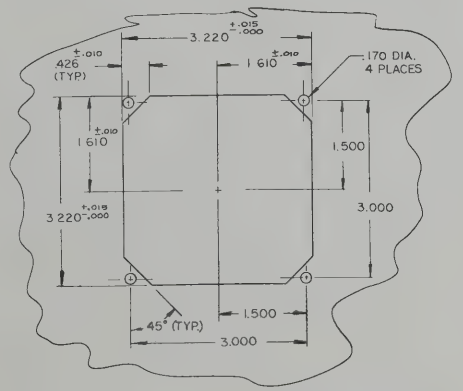
NEXT ASSY	USED ON
APPLICATION	

FINISH
HEAT TREAT

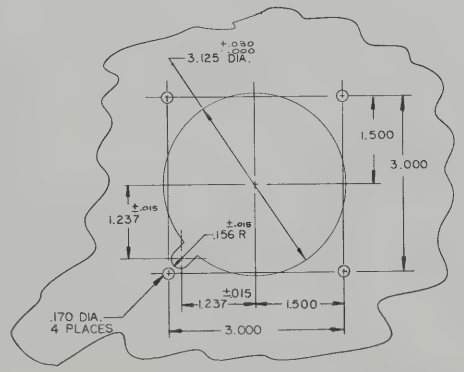
12

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	3-5-69	
B	REVISED PER ECO .9382 BE	2-24-8	

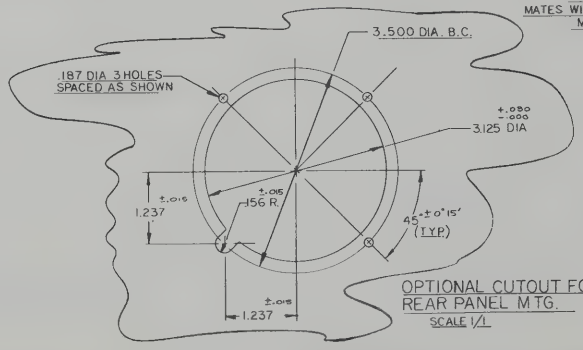




CUTOUT FOR
THROUGH PANEL MTG.
SCALE 1/1



CUTOUT FOR
REAR PANEL MTG.
SCALE 1/1



OPTIONAL CUTOUT FOR
REAR PANEL MTG.
SCALE 1/1

4080-2
B

4. FOR ENG. SPEC. SEE 712889
3. FOR SCHEMATIC SEE 3B708650.
2. FOR ASSY. DWG. SEE 1U708303.
1. ALL DIMENSIONS ARE (REF.) FOR INSTALLATION PURPOSES ONLY.

NOTES:

NEXT ASSY.	USED ON
APPLICATION	

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	REV STA

LIST OF MATERIAL

	NAME	DATE
DWN. MURRAY		6-26-69
MECH. ENG.		6-26-69
CHKR.		6-27-69
PROJ. ENG.		6-26-69
BASIC MODEL 4080		
MODEL NO. 4080 B		
DRAWING SIZE D	SCALE 2/1 & NOTED	WT. 1.2 LB.

INSTALLATION DATA
COURSE SELECTOR
INDICATOR
MODEL 4080B

DRAWING NO. 4080-2 B

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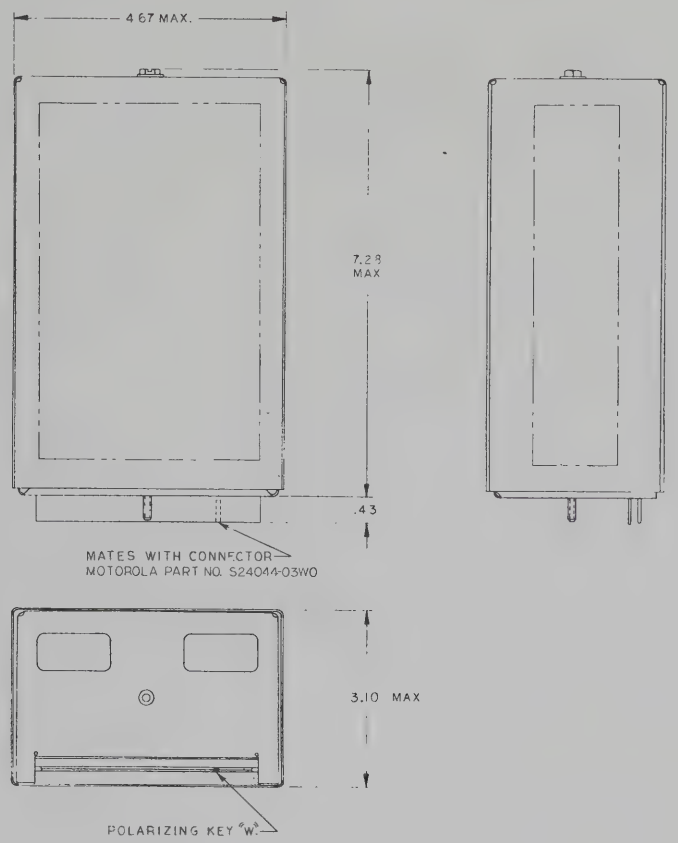
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	17 JUNE 69	
B	ECO 16057 ADDED FOR EQUIVALENT	30 MAY 69	
C	ECO 16694 ADDED C+D ADDRESS	17 FEB 71	
D	REVISED PER ECO 19402	16 NOV 72	
E	ECO 19730 ENG. CONNECTOR	28 AUG 73	



2355-1-
E

NOTES:
1. DIMENSIONS SHOWN ARE FOR INSTALLATION PURPOSES ONLY.
2. FINAL ASSEMBLY NO. IV713400-01, 2355A, IV713400-02, 2355B, IV713400-03 2355C, IV713400-04 2355D.
3. SCHEMATIC DIAGRAM NO. 3D713401

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES

LIST OF MATERIAL

DWN.		
MECH. ENG.		
CHKR.	Benkard	17 JUNE 69
PROJ. ENG.		
NAME		DATE
BASIC MODEL	LNC100	
MODEL NO	2355 ABCD	
DRAWING SIZE	D	

INSTALLATION DATA
MODEL 2355 ABCD
POWER SUPPLY-AMPLIFIER MODULATOR ASSEMBLY

SCALE 1/1 — DO NOT SCALE DRAWING — WT. 2.75 LB.

DRAWING NO. 2355-1-E

NEXT ASSY	USED ON
APPLICATION	

FINISH —
HEAT TREAT —

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES & TOLERANCES ARE: MACHINED SURFACES: XX ± .015, XXX ± .005, XXXX ± .0002, ANGLES ± 0° 30'. SAND CAST OR SHEET METAL SURFACES: XX ± .03, ANGLES ± 1°. BEND RADIUS TOLERANCE: .03 R & .06 R ± .01, .09 R & GREATER ± .02.

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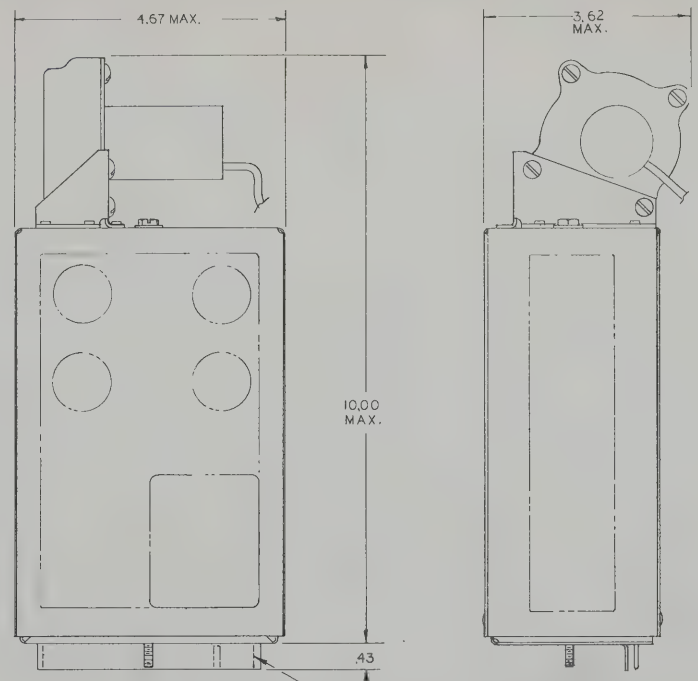
ISSUE	CO NO	CHANGE	DATE	CHK
A	—	RELEASED	11/29/67	
B	179177	CHG'S CONSTRUCTION	4 AUG 69	



2355-2
B

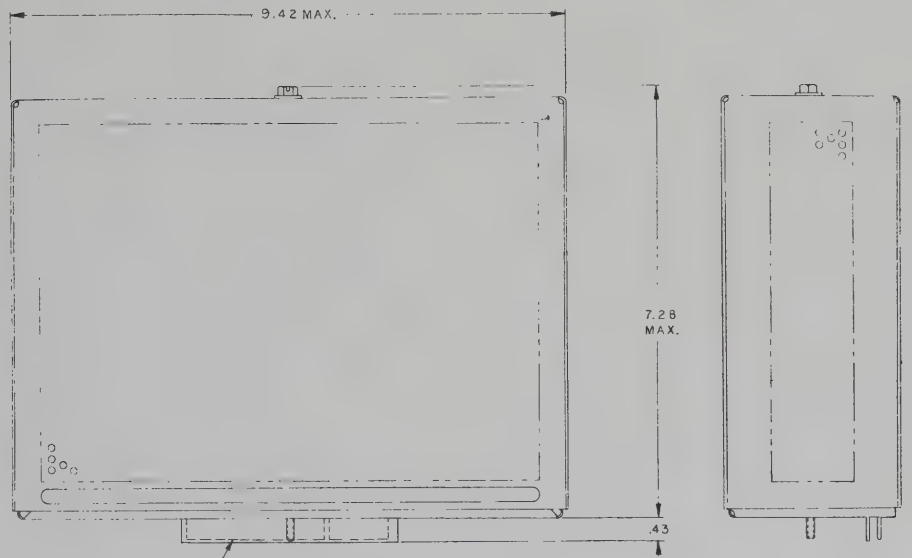
3. SCHEMATIC DIAGRAM NO. 3D713401.
2. FINAL ASSEMBLY NO. 1U713400-05 2355E, 1U713400-06 2355F,
1. DIMENSIONS SHOWN ARE FOR INSTALLATION PURPOSES ONLY

NOTES: UNLESS OTHERWISE SPECIFIED

QUANTITY REQUIRED	PART NO.	TITLE
DWN BY W. Stokes JUNE 13-68		LIST OF PARTS
CHECK Burkhart 4 June 68	MATERIAL	
M. ENG	MATL. SPEC.	
E. ENG [illegible] 13 June 68	FINISH	
NAME DATE	HEAT TREAT	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE: XX ±.010, XXX ±.005, ANGLES ±1°	WEIGHT 3.25 SCALE 1:1	
DO NOT SCALE DWG.	TITLE INSTALLATION DATA MODEL 2355E,F POWER SUPPLY, AMPLIFIER & MODULATOR ASSEMBLY	MOTOROLA INC. SANTA MONICA, CALIFORNIA
PART NO. / NEXT ASSY. / MODEL: 2355E/F / SYSTEM: LNC 100	SIZE D	DWG. NO 2355-2 REVISE B

7427

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	4 Dec 72	EP
B	ECO 15944 CHG MATERIAL IN FIGS 2374A,B	27 Nov 73	RLB
C	REVISED PER ECO 19314 BE	2 Jun 80	chw



2374-1
C

3. SCHEMATIC DIAGRAM NO. 3D713404
2. FINAL ASSEMBLY NO. 1U713403.
1. DIMENSIONS SHOWN ARE FOR INSTALLATION PURPOSES ONLY.

NOTES:

RECD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	FSN

LIST OF MATERIAL

DWN	Wilmer Bolt	MAY 1972
RECH ENG.		
CHEK	Burkart	2 June 72
PROJ. ENG	Hooper	2 June 72
NAME		DATE
BASIC MODEL	LNC100	
MODEL NO.	2374 A(B)(C)(D)	
DRAWING	D	SCALE 1/1

INSTALLATION DATA
MODEL 2374 A,B,C,D,I
VOR LOCALIZER
CONVERTER

DRAWING NO. 2374-1 C

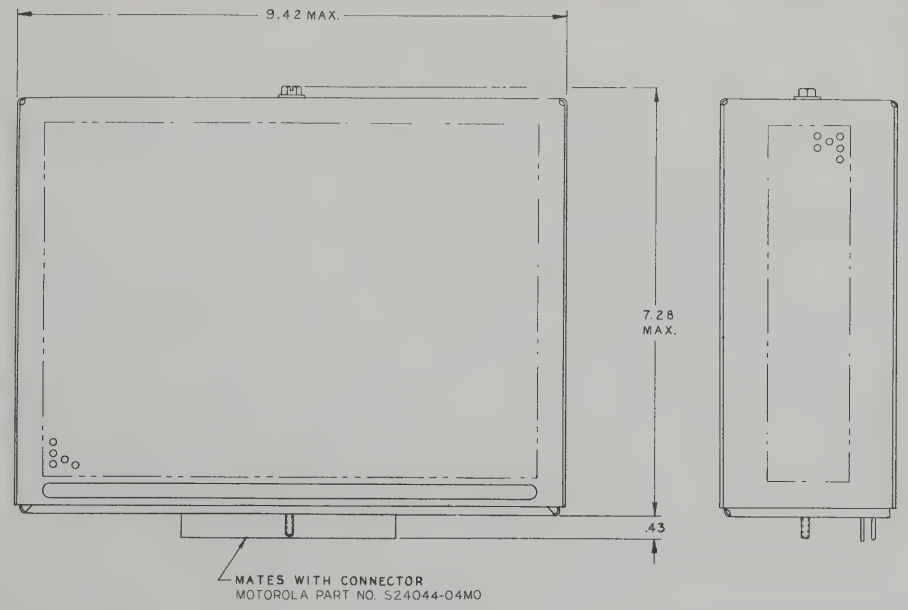
WT. 4.5 LB.

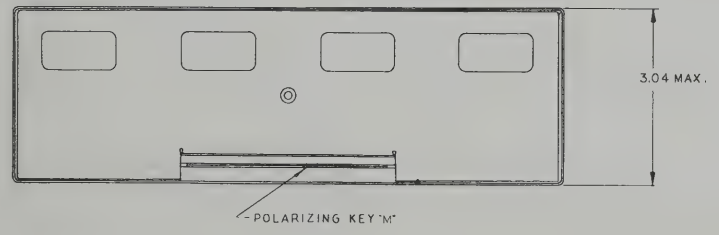
PL713403	2374-A(B)(C)(D)(I)
NEXT ASSY	USED ON
APPLICATION	

FINISH

HEAT TREAT

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	5/16/58	[illegible]
B	REVISED PER ECO 19520 BE	6/13/58	[illegible]





5607-1
B

NOTES:
1. DIMENSIONS SHOWN ARE FOR INSTALLATION PURPOSES ONLY.
2. FINAL ASSEMBLY NO. 1U712333.
3. SCHEMATIC DIAGRAM NO 3D712334.

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	REF DIM

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES & TOLERANCES ARE: MACHINED SURFACES .XX ±.015, .XXX ±.005, .XXXX ±.0005, ANGLES ± 0° 30' SAND CAST OR SHEET METAL SURFACES .XX ± .03 ANGLES ± 1° BEND RADIUS TOLERANCES .03 R & OR R ± .01, .09 R & GREATER ± .03

DWN. NEY-8160 8-13-58
MECH. ENG.
CHKR. [signature] 8/14/58
PROJ. ENG. [signature] 7-15-58
NAME DATE
BASIC MODEL LNC-200
MODEL NO 5607 A
DRAWING SIZE D
SCALE 1/1 DO NOT SCALE DRAWING WT. LB.

INSTALLATION DATA
MODEL 5607A,B,C,D,E&F
GLIDE SLOPE RECEIVER

DRAWING NO. 5607-1 B

NEXT ASSY	USED ON
APPLICATION	

FINISH -- -- --
HEAT TREAT -- -- --

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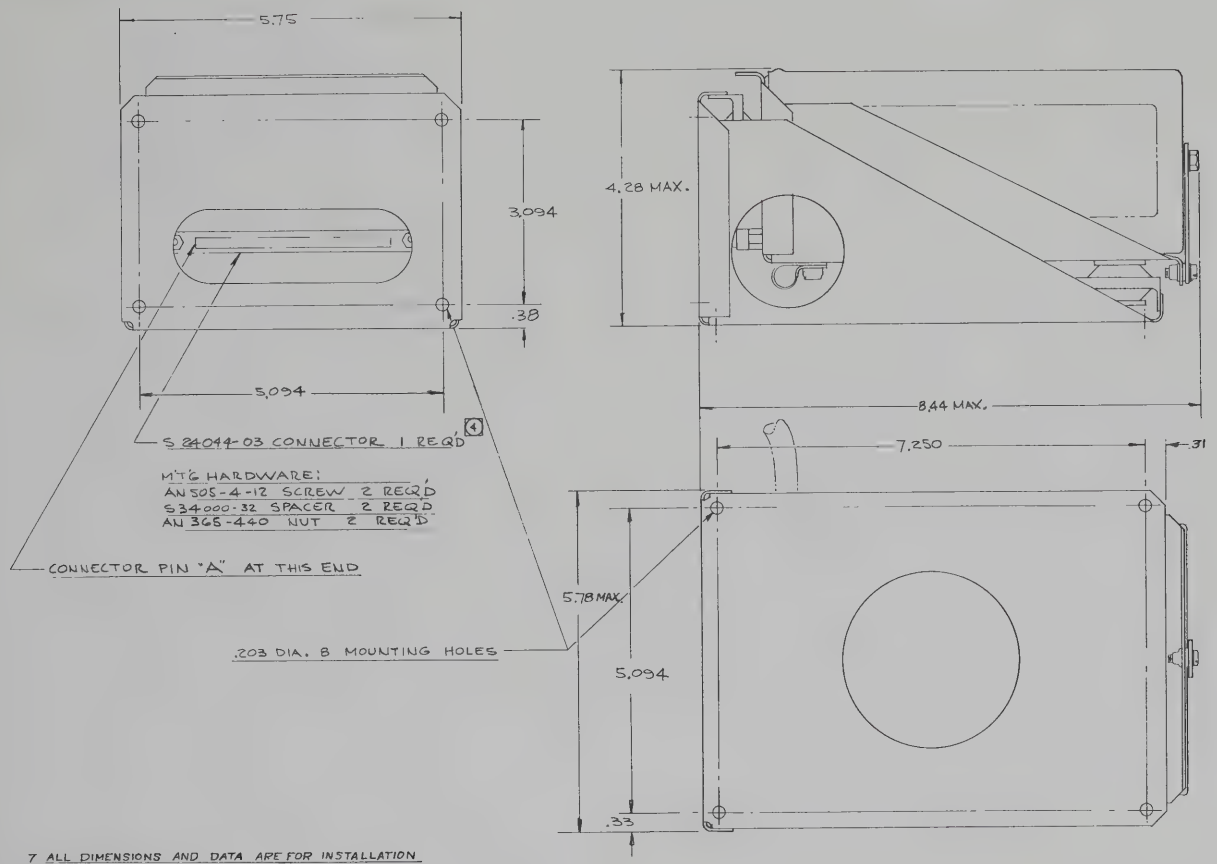
REVISIONS				
SYM	DESCRIPTION	DATE	APPROVAL	
A	EFF RELEASED	28 June 60	GB	
B	SEE ECO 15865; SPACER WAS S34000-04	8th Sept 60	GB	
C	ECO 16059 ADDED "SR. REQ'D TO CONNECT.	NOV 1st 1960	GB	
D	ECO 18321 CORRECT SPACER	OCT 13	GB	
E	ECO 19737 CHG CONNECTOR	AUG 9-60	RDQ	GB



7 ALL DIMENSIONS AND DATA ARE FOR INSTALLATION PURPOSES ONLY.

6 TYPICAL HALF SIZE MODULE IS SHOWN INSTALLED IN SH'KM'T

5. SHOCKMOUNT ASSEMBLY PART NO. 714010

4 FOR CONNECTOR POLARIZING KEY POSITION REFER TO MODULE INSTALLATION DATA DWG

3. CABLE TO BE FREE OF CLAMPS OR RUBBING AGAINST OTHER OBJECTS FOR A MINIMUM OF 8 INCHES IN ORDER TO NOT AFFECT SHOCKMOUNT CHARACTERISTICS

2. CABLE HARNESS MAY EMERGE FROM EITHER END THRU CLEARANCE HOLES. CABLE CLAMP IS PROVIDED WITH SHOCKMOUNT

1. MOUNTING MAY BE IN VERTICAL POSITION OR IN HORIZONTAL POSITION AS SHOWN

NOTES:

714056 E

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	REV SYM

LIST OF MATERIAL

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	NAME	DATE
DWN. W. Stefan		5-19-60
MECH. ENG.		
CHKR. GB		28 June 60
PROJ. ENG. W.R.C./pm		4-19-60
BASIC MODEL LNC 100		
MODEL NO		
DRAWING SIZE D	SCALE 1:1	DO NOT SCALE DRAWING WT. LB.

INSTALLATION DATA-LNC 100 SHOCKM'T ½ SIZE MODULE

DRAWING NO. 714056 E

NEXT ASSY	USED ON
APPLICATION	

FINISH —

HEAT TREAT —

27

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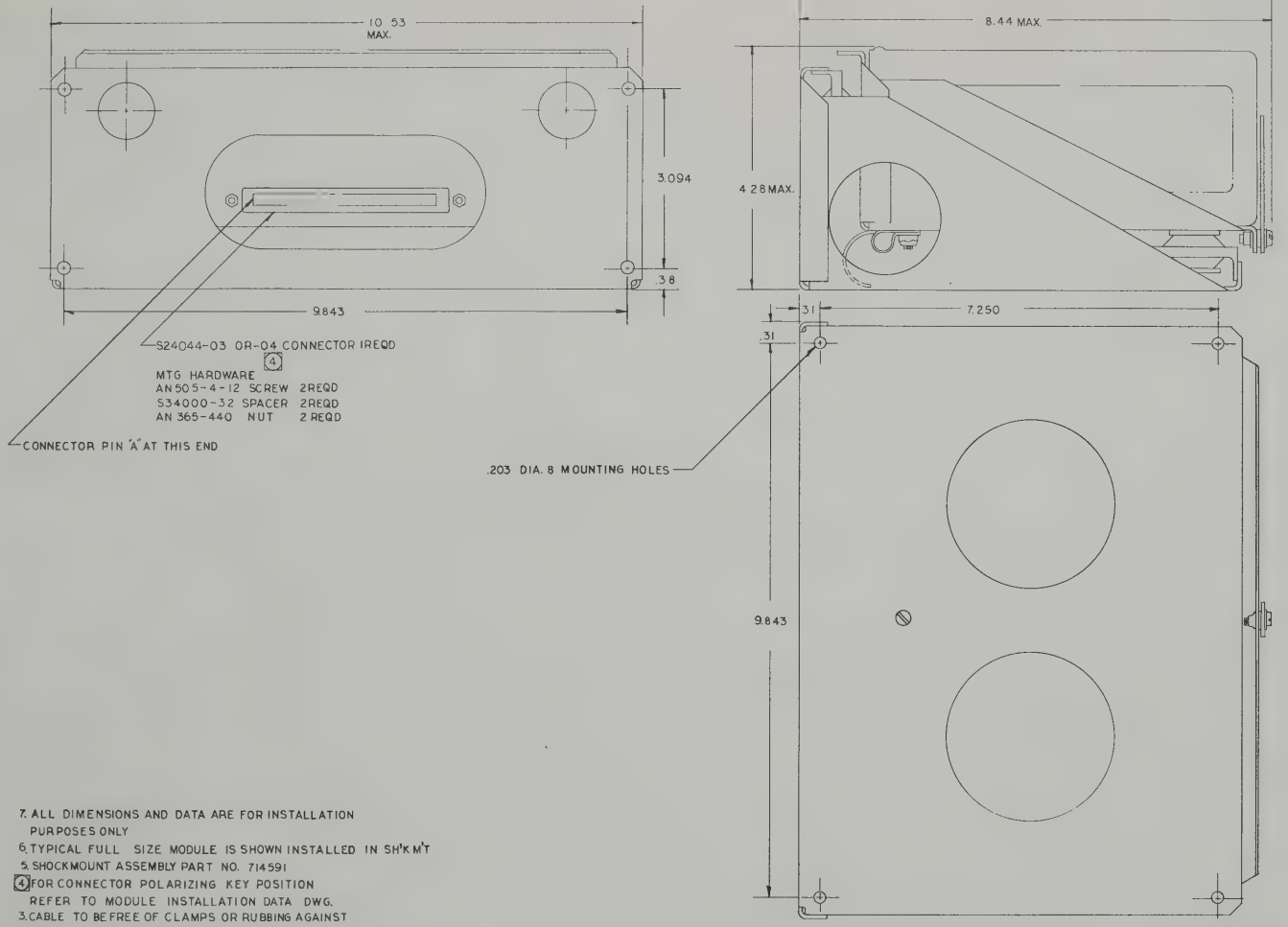
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	RELEASED	7/6/60	[illegible]
B	SEE ECO 15866; SPACER WAS S34000-24	6/2/60	[illegible]
C	ECO 16060 ADDITIONAL CONFIG. #4 CONNECTOR	7/25/60	[illegible]
D	ECO 18324 CORRECT SPACER	8/1/60	[illegible]
E	ECO 19740 CHG CONNECTOR	8 AUG 9-60	[illegible]



714592 E

7. ALL DIMENSIONS AND DATA ARE FOR INSTALLATION PURPOSES ONLY
6. TYPICAL FULL SIZE MODULE IS SHOWN INSTALLED IN SH'K M'T
5. SHOCKMOUNT ASSEMBLY PART NO. 714591
4. FOR CONNECTOR POLARIZING KEY POSITION REFER TO MODULE INSTALLATION DATA DWG.
3. CABLE TO BE FREE OF CLAMPS OR RUBBING AGAINST OTHER OBJECTS FOR A MINIMUM OF 8 INCHES IN ORDER TO NOT AFFECT SHOCKMOUNT CHARACTERISTICS
2. CABLE HARNESS MAY EMERGE FROM EITHER END THRU CLEARANCE HOLES CABLE CLAMP IS PROVIDED WITH SHOCKMOUNT
1. MOUNTING MAY BE IN VERTICAL POSITION, OR IN HORIZONTAL POSITION AS SHOWN

NOTES

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NEXT ASSY	USED ON
APPLICATION	

FINISH —— HEAT TREAT ——

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	REV LTR
LIST OF MATERIAL							

DWN Wm. Curtis 8-15-60
MECH. ENG.
CHKR. C.L. Wade 7/14/60
PROJ. ENG.
NAME DATE
BASIC MODEL LNC-100
MODEL NO. ——
DRAWING SIZE D
SCALE DO NOT SCALE PRINTS WT. —— LB.

INSTALLATION DATA
LNC-100 SHOCKMOUNT
FULL SIZE MODULE

DRAWING NO. 714592 E

APPENDIX II

PARTS LISTS

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Series 101-199	Model 5640A, 14V or 28V. Part of LNC-100 System. Approx 3 1/4" wide x 3 1/4" high x 12 1/2" long.	280 channel (max) VHF Transmitter in the range 108 - 131.95 mc. 50 or 100 kc channel separation	713409
C-101	Capacitor, Fixed, Ceramic Dielectric; 3/8 in. OD disc 0.001 uf min value, 500 wvdc	TP-101 Bypass	90732-03
C-102	Same as C-101	V-101A cathode bypass	--
C-103	Same as C-101	R-104 bypass	--
C-104	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wdvc	Coupling from V-101A to mixer	--
C-105	Capacitor, Fixed, Mica Dielectric; 15 uuf ± 10%, 500 wvdc	Grid coupling to V-102	705148-150KC
C-106	Capacitor, Fixed, Mica Dielectric; 10 uuf ± 10%, 500 wvdc	Grid coupling from V-101B to V-102	705148-100KD
C-107	Same as C-101	TP-103 bypass	--
C-108	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Coupling from V-101A to mixer	--
C-109	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Coupling from V-101A to mixer	--
C-110	Capacitor, Fixed, Mica Dielectric; 500 uuf ± 10%, 300 wvdc	Coupling from V-102 to T-101	705148-501-KF
C-111	Capacitor, Fixed, Mica Dielectric; 22 uuf ± 20%, 500 wvdc	Grid coupling from M.C. crystal to V-101A	705148-220-MC
C-112	Capacitor, Variable, Air Dielectric; 0.7 - 3.0 uuf, 350 wvdc	V-102 plate tuning	710501
C-113	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Coupling from V-101A to mixer	--
C-114	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-102B + bypass	--
C-115	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Tunes secondary of T-101	--
C-116	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	TP-104 bypass	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-117	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-103 cathode bypass	--
C-118	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-103 cathode bypass	--
C-119	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-103 screen bypass	--
C-120	Same as C-110	V-103 plate coupling	--
C-121	Capacitor, Fixed, Ceramic Dielectric; 5/16 in. OD disc 7 uuf ± 10%, 600 wvdc	V-103 plate tuning	90732-19
C-122	Same as C-112	V-103 plate tuning	--
C-123	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-103B + bypass	--
C-124	Same as C-104	V-103B + bypass	--
C-125	Capacitor, Fixed, Ceramic Dielectric; 27 uuf ± 10%, 500 wvdc	B + bypass	97529-19
C-126	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	TP-105 bypass	--
C-127	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	R-118 bypass	--
C-128	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-104 cathode bypass	--
C-129	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-104 screen bypass	--
C-130	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-104 cathode bypass	--
C-131	Same as C-104	B + bypass	--
C-132	Capacitor, Fixed, Mica Dielectric; 500 uuf ± 10%, 500 wvdc	B + blocking	706751-501KD
C-133	Capacitor, Fixed, Mica Dielectric; 3 uuf ± 20%, 500 wvdc	V-104 plate tuning	705148-030MC
C-134	Same as C-112	V-104 plate tuning	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-135	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-104 plate bypass	--
C-136	Capacitor, Fixed, Mica Dielectric; 56 uuf ± 10%, 500 wvdc	p/o antenna impedance matching capacitor w/C-137	705148-560KC
C-137	Capacitor, Fixed, Mica Dielectric; 33 uuf ± 10%, 500 wvdc	p/o antenna impedance matching capacitor w/C-136	705148-330 KC
C-138	Same as C-101	TP-101 bypass	--
C-139	Same as C-101	B + bypass	--
C-140	Same as C-110	Keeps B + off crystals	--
C-141	Same as C-101	Filament bypass	--
C-142	Same as C-101	Filament bypass	--
C-143	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Filament bypass	--
C-144	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Filament bypass	--
C-145	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Filament bypass	--
C-146	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Filament bypass	--
C-147	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	Filament bypass	--
C-148	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-102B + bypass	--
DL-101	Lamp (14V only)	Dial illumination	97395
	Lamp (28V only)	Dial illumination	MS25237-327
EX-101	Transmitter Subassembly Etched circuit (including V-101, V-102, V-103, V-104 & associated components)	Transmitter circuit	713647
I-101	Panel, Light	Mounts DL-101	701392-04
J-102	Connector, Receptacle, Male, 1 Pin	Antenna connector	708356-02
L-101	Coil assembly	Low Pass filter	714746

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
L-102	Coil assembly (mounted on switch wafer)	V-101A plate tuning	705166-04
L-103	Coil assembly	V-101A plate tuning	713626
L-104	Coil assembly	B + choke to V-101A	713622
L-105	Choke, R F	V-102B + choke	S17022
L-106	Coil assembly (mounted on switch wafer)	V-102 plate tuning	713635
L-107	Same as L-105	V-103B + choke	--
L-108	Coil assembly	V-103 plate tuning	713625
L-109	Not Used		
L-110	Same as L-105	V-104 grid return, TP-105 RF choke	--
L-111	Same as L-105	RF choke, audio pass	--
L-112	Same as L-108	V-104 plate tuning	--
L-113	Same as L-106	V-104 plate tuning	--
L-114	Coil assembly	V-101B plate RF choke	713649
L-115	Coil assembly	V-101B plate tuning	713627
L-119	Same as L-106	V-103 plate tuning	--
MP-101	Clamp, Cable	Holds P-101 to its cable	S24028-C24
MP-102	Knob, MC	Unit MC selector	711670-06
MP-103	Knob, KC	Fractional MC selector	714871-02
P-101	Connector, Plug, 9 prong, male	Connects transmitter to A+, B+, modulated B+ dimmer control, and provides ground for power supply, mates w/J-101	S24028-P9
R-101	Resistor, Fixed, Composition; 47K ± 10%, 1/2 w	TP-102 voltage dropping	S11012-473-K
R-102	Resistor, Fixed, Composition; 4.7K ohms ± 10%, 1/2 w	V-101A grid return	S11012-472-K
R-103	Resistor, Fixed, Composition; 100 ohms ± 10%, 1/2 w	V-101A cathode bias	S11012-101-K
R-104	Resistor, Fixed, Composition; 2.2K ± 10%, 1/2 w	V-101A plate voltage dropping	S11012-222-K
R-105	Same as R-101	TP-103 voltage dropping	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-106	Resistor, Fixed, Composition; 10K ohms ± 10%, 1/2 w	V-102 grid return	S11012-103-K
R-107	Resistor, Fixed, Composition; 22K ohm ± 10%, 1/2 w	V-102 screen voltage dropping	S11012-233-K
R-108	Resistor, Fixed, Composition; 220 ohms ± 10%, 1/2 w	V-102 cathode bias	S11012-221-K
R-109	Resistor, Fixed, Composition; 10 ohms ± 10%, 1/2 w	Isolates L-105 and C-113	S11012-100-K
R-110	Same as R-103	V-102 plate voltage dropping	--
R-111	Same as R-106	TP-104 voltage developing	--
R-112	Same as R-107	TP-104 voltage dropping	--
R-113	Same as R-107	TP-104 voltage dropping	--
R-114	Resistor, Fixed, Composition; 100 ohms ± 10%, 1 w	V-103 cathode bias	S11013-101-K
R-115	Same as R-103	V-103 screen voltage dropping	--
R-116	Same as R-103	V-103B+ voltage droping	--
R-117	Same as R-106	V-104 grid return	--
R-118	Same as R-101	TP-105 voltage dropping	--
R-119	Same as R-103	TP-105 voltage dropping	--
R-120	Same as R-114	V-104 cathode bias	--
R-121	Same as R-103	V-104 screen voltage dropping	--
R-122	Same as R-103	Mod. B+ voltage dropping	--
R-123	Same as R-101	TP-101 voltage dropping	--
R-124	Resistor, Fixed, Composition; 330 ohms ± 10%, 1/2 w	Fractional MC crystal voltage developing	S11012-331-K
R-125	Same as R-106	V-101A grid return	--
R-126	Same as R-108	V-101A cathode bias	--
R-127	Same as R-104	V-101B plate voltage dropping	--
R-128	Not Used		

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-129	Resistor, Fixed, Composition; 130 ohms ± 5%, 1/2 w	Current bypass for filament of V-101	S11012-131-J
R-130	Same as R-129	Current bypass for filament of V-102	--
R-131	Same as R-103	V-102 plate voltage dropping	--
S-101	Switch, Rotary	Selects crystals Y-101 to Y-120	713633
S-102	Switch, Rotary	Selects crystals Y-121 to Y-134	713634
T-101	Coil assembly	V-102 tuning and coupling to V-103	713623
V-101	Electron Tube, 12AT7	MC oscillator	S12000-029
V-102	Electron Tube, 6BC5	Mixer	S12000-044
V-103	Electron Tube, 5686	Driver	S12000-018
V-104	Same as V-103	Power Amplifier	--
XV-101	Socket, Electron Tube	Mounts V-101	S23006-9BMPG
XV-102	Socket, Electron Tube	Mounts V-102	S23006-7BMPG
XV-103	Same as XV-101	Mounts V-103	--
XV-104	Same as XV-101	Mounts V-104	--
Y-101	Crystal, Quartz; 36.00 MC	XXX.00 MC crystal See table 3-2	713636-21
Y-102	Crystal, Quartz; 36.05 MC	XXX.05 MC crystal See table 3-2	713636-22
Y-103	Crystal, Quartz; 36.10 MC	XXX.10 MC crystal See table 3-2	713636-23
Y-104	Crystal, Quartz; 36.15 MC	XXX.15 MC crystal See table 3-2	713636-24
Y-105	Crystal, Quartz; 36.20 MC	XXX.20 MC crystal See table 3-2	713636-25
Y-106	Crystal, Quartz; 36.25 MC	XXX.25 MC crystal See table 3-2	713636-26
Y-107	Crystal, Quartz; 36.30 MC	XXX.30 MC crystal See table 3-2	713636-27
Y-108	Crystal, Quartz; 36.35 MC	XXX.35 MC crystal See table 3-2	713636-28

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Y-109	Crystal, Quartz; 36.40 MC	XXX.40 MC crystal See table 3-2	713636-29
Y-110	Crystal, Quartz; 36.45 MC	XXX.45 MC crystal See table 3-2	713636-30
Y-111	Crystal, Quartz; 36.50 MC	XXX.50 MC crystal See table 3-2	713636-31
Y-112	Crystal, Quartz; 36.55 MC	XXX.55 MC crystal See table 3-2	713636-32
Y-113	Crystal, Quartz; 36.60 MC	XXX.60 MC crystal See table 3-2	713636-33
Y-114	Crystal, Quartz; 36.65 MC	XXX.65 MC crystal See table 3-2	713636-34
Y-115	Crystal, Quartz; 36.70 MC	XXX.70 MC crystal See table 3-2	713636-35
Y-116	Crystal, Quartz; 36.75 MC	XXX.75 MC crystal See table 3-2	713636-36
Y-117	Crystal, Quartz; 36.80 MC	XXX.80 MC crystal See table 3-2	713636-37
Y-118	Crystal, Quartz; 36,85 MC	XXX.85 MC crystal See table 3-2	713636-38
Y-119	Crystal, Quartz; 36.90 MC	XXX.90 MC crystal See table 3-2	713636-39
Y-120	Crystal, Quartz; 36.95 MC	XXX.95 MC crystal See table 3-2	713636-40
Y-121	Crystal, Quartz; 82.00 MC	118 - 118.95 MC crystal See table 3-2	713636-51
Y-122	Crystal, Quartz; 83.00 MC	119-119.95 MC crystal See table 3-2	713636-52
Y-123	Crystal, Quartz; 84.00 MC	120-120.95 MC crystal See table 3-2	713636-53
Y-124	Crystal, Quartz; 85.00 MC	121-121.95 MC crystal See table 3-2	713636-54
Y-125	Crystal, Quartz; 86.00 MC	122-122.95 MC crystal See table 3-2	713636-55
Y-126	Crystal, Quartz; 87.00 MC	123-123.95 MC crystal See table 3-2	713636-56
Y-127	Crystal, Quartz; 88.00 MC	124-124.95 MC crystal See table 3-2	713636-57
Y-128	Crystal, Quartz; 89.00 MC	125-125.95 MC crystal See table 3-2	713636-58

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Y-129	Crystal, Quartz; 90.00 MC	126-126.95 MC crystal See table 3-2	713636-59
Y-130	Crystal, Quartz; 91.00 MC	127-127.95 MC crystal See table 3-2	713636-60
Y-131	Crystal, Quartz; 92.00 MC	128-128.95 MC crystal See table 3-2	713636-61
Y-132	Crystal, Quartz; 93.00 MC	129-129.95 MC crystal See table 3-2	713636-62
Y-133	Crystal, Quartz; 94.00 MC	130-130.95 MC crystal See table 3-2	713636-63
Y-134	Crystal, Quartz; 95.00 MC	131-131.95 MC crystal See table 3-2	713636-64

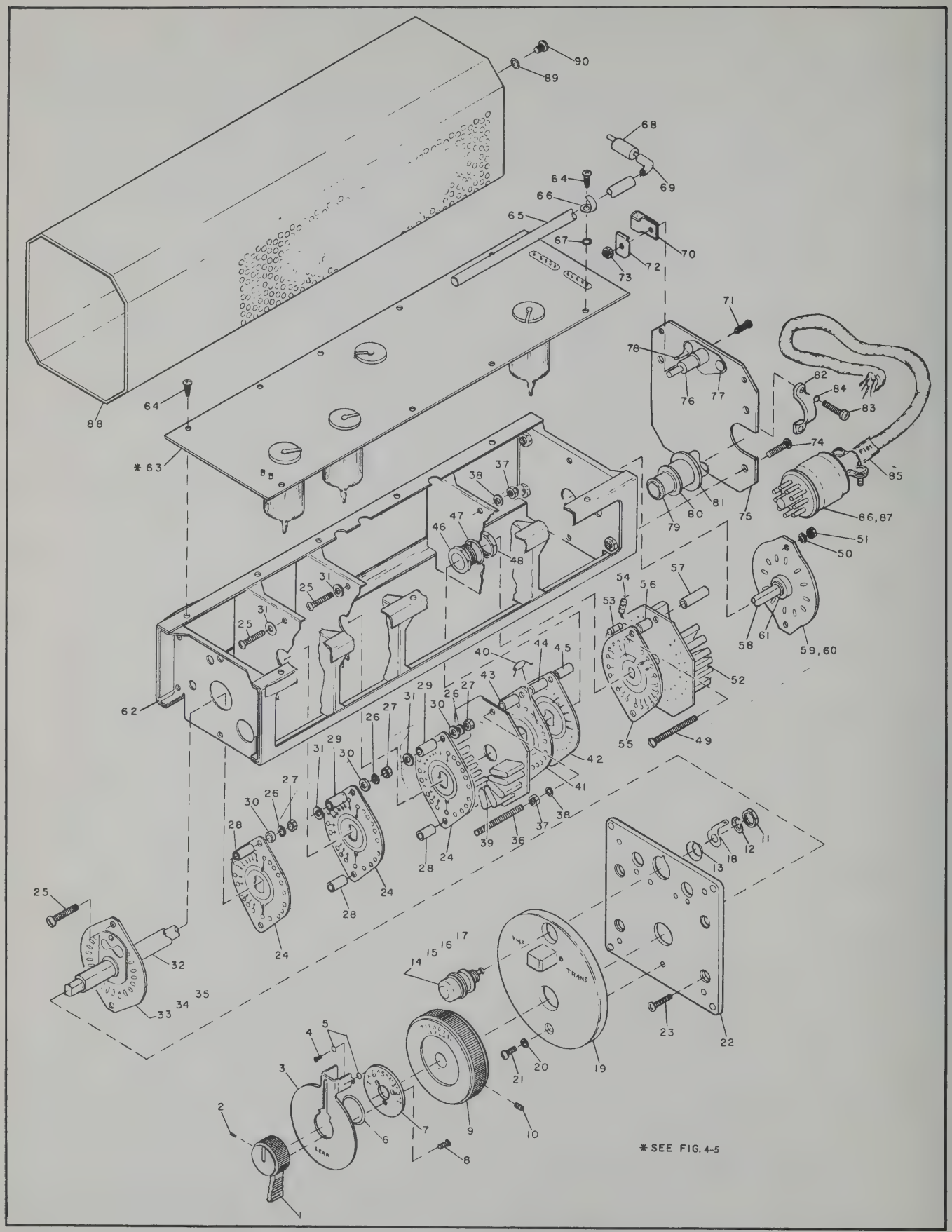

Figure II-1. Model 5640A Transmitter, Exploded View

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-1-	713409	TRANSMITTER, MODEL 5640A	1	
-1	714871-02	. KNOB	1	
		(ATTACHING PARTS)		
-2	S46006-4-C-2-P	. SCREW, Set, hex socket head no. 4-40 by 1/8 lg steel	2	
		-----*-----		
-3	710856	. MASK, Remote Head	1	
		(ATTACHING PARTS)		
-4	711853	. SCREW	2	
-5	91039-17	. O RING	4	
		-----*-----		
-6	714933	. SHIM	1	
-7	711671	. DIAL	1	
		(ATTACHING PARTS)		
-8	AN510-2-3	. SCREW, Mach. flat head 82° no. 2-56 by 3/16 in. lg steel	3	
		-----*-----		
-9	711670-06	. KNOB	1	
		(ATTACHING PARTS)		
-10	S46006-4-C-2-P	. SCREW, Set, hex socket head no. 4-40 by 1/8 lg steel	2	
		-----*-----		
	701392-04	. LAMPHOLDER (including lock washer, and mounting nut)	1	
		(ATTACHING PARTS)		
-11	712285	. . NUT, Plain, Hex	1	
-12	AN935-10L	. . WASHER, Lock Spring	1	
		-----*-----		
-13	712286	. . SPACER, Lampholder	1	
-14	712287	. . SOCKET, Lampholder	1	
-15	712288	. . WASHER, Rubber 7/16 ID by 11/16 by 3/32 in. thick	1	
-16	712289	. . CAP, Lampholder	1	
-17	97395	. LAMP, 14V	1	
-18	S32002-3S	. LUG	1	
-19	711896-01	. PANEL, Round	1	
		(ATTACHING PARTS)		
-20	91039-17	. O RING	1	
-21	Q5413-02-06	. SCREW	1	
		-----*-----		
-22	713619	. PANEL, Mounting	1	
		(ATTACHING PARTS)		
-23	712915-02	. SCREW, F.H. Mach 6-32	4	
		-----*-----		
-24	713635	. . WAFER	3	
		(ATTACHING PARTS)		
-25	Q5413-05-12	. . SCREW 5-40 X 3/4	2	
-26	56196	. . WASHER, Internal Lock	2	
-27	S45002-03	. . NUT, Hex 5-40	2	
		-----*-----		
-28	60562-09	. . SPACER - 5/16	4	
-29	714809-02	. . SPACER - .250	2	
-30	S34000-22	. . SPACER - 1/16	6	
-31	54001	. . WASHER, Flat	4	
	713612	. . INDEX ASSEMBLY, MC	1	
-32	713616-01	. . . SHAFT, MC	1	
-33	713613	. . . PLATE, MC	1	
-34	AN216C2-12	. . . BEARING, Ball	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-1-35	63185-05	. . . RING, Retaining	1	
		(ATTACHING PARTS)		
	713638	. . CRYSTAL ASSEMBLY, Unit MC	1	
-36	S46008-11	. . ROD, Threaded 5-40 X 1.31	2	
-37	S45002-03	. . NUT, Hex 5-40	4	
-38	56196	. . WASHER, Internal Lock	4	
		-----*-----		
-39	See Parts List	. . . CRYSTALS Y121 thru Y134		
-40	713621	. . . COIL ASSEMBLY	1	
-41	713634	. . . WAFER	1	
-42	705166-04	. . WAFER	1	
-43	60562-05	. . SPACER - 3/16	2	
-44	704887-01	. . SPACER - 1/4	2	
-45	60562-09	. . SPACER - 5/16	2	
-46	713615	. . BUSHING, MC Shaft	1	
		(ATTACHING PARTS)		
-47	70768	. . WASHER, Internal Lock	1	
-48	13496	. . NUT, Hex	1	
	713637-02	. . CRYSTAL ASSEMBLY, Fractional MC	1	
		(ATTACHING PARTS)		
-49	AN515-5-20	. . SCREW 5-40 X 1 1/4	2	
-50	56196	. . WASHER, Internal Lock	2	
-51	S45002-03	. . NUT, Hex 5-40	2	
		-----*-----		
-52	See Parts List	. . . CRYSTALS Y101 thru Y119		
-53	S11012-331-K	. . . RESISTOR, 330 ohms ±10% 1/2 W	1	
-54	S11012-561-K	. . . RESISTOR, 560 ohms ±10% 1/2 W	1	
-55	713633	. . . WAFER	1	
-56	60562-05	. . SPACER - 3/16	2	
-57	60562-10	. . SPACER - 11/16	2	
	713606	. . INDEX ASSEMBLY, Fractional MC	1	
-58	713607	. . . SHAFT, Fractional MC	1	
-59	713609	. . . PLATE, Fractional MC	1	
-60	AN21602-12	. . . BEARING, Ball	1	
-61	63185-02	. . . RING, Retaining	1	
-62	713600	. . FRAME	1	
-63	713647	. BOARD ASSEMBLY (See Fig. 4-5)	1	
		(ATTACHING PARTS)		
-64	43700SC-4BP5	. SCREW	10	
		-----*-----		
	714746	. FILTER, Low Pass	1	
		(ATTACHING PARTS)		
-65	713639	. TUBING	1	
-66	714932	. LUG, Ground Type	2	
-67	S36002-001	. WASHER, Nylon	2	
		-----*-----		
-68	712880-05	. . TUBING	1	
-69	S44018-02	. . CABLE, Min Coax 50 ohms	1	
-70	701030-04	. CLIP, Cable	1	
		(ATTACHING PARTS)		
-71	Q6413-04-05	. SCREW	1	
-72	701031-01	. WASHER, Cable Clip	1	
-73	AN365-440A	. NUT, Self Locking	1	
		-----*-----		

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-1-	713878	. PLATE ASSEMBLY, Rear Identification	1	
		(ATTACHING PARTS)		
-74	5413-04-12	. SCREW	4	
		-----*-----		
-75	713620-02	. . PLATE, Rear	1	
-76	708356-02	. . JACK, Shielded Antenna Connect	1	
		(ATTACHING PARTS)		
-77	AN430-AD4-3	. . RIVET	2	
		-----*-----		
-78	S32000-02A	. . LUG, Solder	1	
-79	AN3420-6	. BUSHING	1	
-80	AN3420-8	. BUSHING	1	
-81	713727	. WASHER, Flat	1	
	No Number	. CABLE ASSEMBLY	1	
		(ATTACHING PARTS)		
-82	713795	. CLAMP, Cable	1	
-83	Q6513-06-07	. SCREW	2	
-84	AN935-6L	. WASHER	2	
		-----*-----		
-85	97541-26	. MARKER, Tab	1	
-86	S24028-024	. PLUG, Cap	1	
-87	S24028-P9	. CONNECTOR	1	
-88	712261-02	. COVER	1	
		(ATTACHING PARTS)		
-89	AN936A4	. WASHER, Internal Tooth	3	
-90	Q6413-04-04	. SCREW	3	

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Series 201 to 299	Receiver, VHF, crystal controlled, Model 5611A, 14V or 28V. Part of LNC-100 System. Approx. 3 1/4" wide x 3 1/4" high x 14 1/4" long (including cable clearance)	230 channel (max) VHF Receiver in the frequency range 108.00 to 130.90 MC. 100 kc channel separation	715051
C-201	Capacitor, Fixed, Mica Dielectric; 56 uuf ± 10%, 500 wvdc	Tunes L-201	705148-560-KD
C-202	Capacitor, Fixed, Mica Dielectric; 47 uuf ± 10%, 500 wvdc	Coupling to V-201 grid	705148-470-KD
C-203	Capacitor, Fixed, Ceramic Dielectric; 19/32 in. OD disc 0.01 uf min value, 500 wvdc	RF bypass	90732-07
C-204	Capacitor, Fixed Electrolytic; 5 uf ± 150% -10%, 25 wvdc	AF bypass	S10003-5-25
C-205	Not Used		
C-206	Capacitor, Fixed, Ceramic Dielectric; 3/8 in. OD disc 0.001 uf min value, 500 wvdc	V-201 Screen bypass	90732-03
C-207	Capacitor, Fixed, Titanium Dioxide Dielectric; 4.7 uuf ± 10%, 500 wvdc	V-201 coupling to V-202A grid	S10021-4R7-KQ
C-208	Same as C-206	V-202A Screen bypass	--
C-209	Capacitor, Fixed, Titanium Dioxide Dielectric; 1.5 uuf ± 10%, 500 wvdc	V-202A coupling to V-203	S10021-1R5-KQ
C-210	Capacitor, Fixed, Mica Dielectric; 20 uuf ± 10%, 500 wvdc	Tunes L-205	705148-200-KD
C-211	Same as C-206	V-202A plate bypass	--
C-212	Capacitor, Fixed, Mica Dielectric; 15 uuf ± 10%, 500 wvdc	Tunes L-206	705148-150-KC
C-213	Capacitor, Fixed, Mica Dielectric; 100 uuf ± 10%, 500 wvdc	AVC blocking	705148-101-KC
C-214	Capacitor, Fixed, Mica Dielectric; 19/32 in. OD disc 0.01 uf +80% -10%, 600 wvdc	RF bypass	90732-11
C-215	Capacitor, Fixed, Ceramic Dielectric; 1/4 in. OD disc 470 uuf min value, 500 wvdc	V-203 cathode bypass	90732-01
C-216	Same as C-206	V-203 Screen bypass	--
C-217	Capacitor, Fixed, Mica Dielectric; 30 uuf ± 10%, 500 wvdc	Tunes primary of T-201	705148-300-KD
C-218	Same as C-206	V-203 plate bypass	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-219	Same as C-213	V-204A grid coupling	--
C-220	Same as C-214	V-204A plate bypass	--
C-221	Same as C-214	V-204A screen bypass	--
C-222	Capacitor, Fixed, Ceramic Dielectric; 3/4 in. OD disc 0.05 uf +80% -20%, 300 wvdc	RF bypass	90732-24
C-223	Same as C-213	V-205A grid coupling	--
C-224	Same as C-206	V-205A screen bypass	--
C-225	Same as C-203	V-205A cathode bypass	--
C-226	Same as C-203	V-205A plate bypass	--
C-227	Same as C-203	V-206A cathode bypass	--
C-228	Same as C-203	V-206A screen bypass	--
C-229	Same as C-203	V-206A plate bypass	--
C-230	Same as C-203	RF bypass	--
C-231	Same as C-222	Coupling to V-207	--
C-232	Same as C-222	AGC bypass	--
C-233	Same as C-215	RF bypass	--
C-234	Same as C-222	p/o noise limiter AF voltage divider w/R-227	--
C-235	Same as C-203	B + bypass	--
C-236	Same as C-215	Feedback for MC oscillator	--
C-237	Capacitor, Fixed, Titanium Dioxide Dielectric; 3.3 uuf ± 10%, 500 wvdc	V-202B coupling to V-202A grid	S10021-3R3-KQ
C-238	Not Used		
C-239	Same as C-206	V-204B plate bypass	--
C-240	Same as C-203	B + bypass	--
C-241	Capacitor, Fixed, Mica Dielectric; 24 uuf ± 5%, 500 wvdc	p/o KC oscillator feedback circuit w/C-242	705148-240-JC
C-242	Capacitor, Fixed, Mica Dielectric; 110 uuf ± 10%, 500 wvdc	p/o KC oscillator feedback circuit w/C-241	705148-111-KD
C-243	Same as C-206	RF bypass	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-244	Same as C-222	Audio coupling from V-207 to R-248	--
C-245	Capacitor, Fixed, Paper Dielectric; 0.1 uf ± 10%, 200 wvdc	V-207 audio bypass	708197-42
C-246	Same as C-222	V-207, Pin 2, audio bypass	--
C-247	Same as C-203	V-205B plate bypass	--
C-248	Same as C-222	Coupling to V-205B grid	--
C-249	Same as C-203	A + bypass	--
C-250	Capacitor, Fixed, Paper Dielectric; 1 uf ± 20%, 150 wvdc	AGC bypass	S10011-02
C-251	Same as C-206	V-204 filament bypass	--
C-252	Same as C-206	V-204 filament bypass	--
C-253	Same as C-206	V-202 filament bypass	--
C-254	Same as C-206	V-202 filament bypass	--
C-255	Same as C-206	V-201 filament bypass	--
C-256	Same as C-206	V-201 filament bypass	--
C-257	Same as C-206	V-203 filament bypass	--
C-258	Same as C-206	V-203 filament bypass	--
C-259	Same as C-203	V-206 filament bypass	--
C-260	Same as C-203	V-206 filament bypass	--
C-261	Same as C-203	V-205 filament bypass	--
C-262	Same as C-214	B + bypass	--
C-263	Same as C-222	AGC bypass	--
C-264	Same as C-222	AGC bypass	--
C-265	Capacitor, Fixed, Ceramic Dielectric; 3/8 in. OD disc 0.001 uf min value 500 wvdc	Marker Beacon Sensitivity control RF bypass	90732-03
C-266	Same as C-206 (Schematic 715052 B, C, D, E)	(Schematic 715052 B, C, D, E)	--
C-267	Capacitor, Fixed, Mica Dielectric; 390 uuf ± 10%, 500 wvdc (Schematic 715052 B, C, D, E)	V-206 RF bypass (Schematic 715052 B, C, D, E)	705148-391-KD
CR-201	Rectifier, Clevite CTP2111	Noise limiter	S12002-037

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
I-201	Lamp, Dial (14V) OR	Dial illumination (14V operation only)	97395
	Lamp, Dial (28V)	Dial illumination (28V operation only)	97635-103
J-201	Jack, Shielded Antenna Connect	Antenna connector mates w/plug on antenna cable	708356
J-202	Connector, Receptacle, 11 pin Female	Connects Model 5611A to Glide Slope Receiver channels 1 thru 10, Model 2374 module relay control. Mates w/P-202	S24028-S11
L-201	Coil, RF	p/o V-201 grid tuning w/L-202	713851-01
L-202	Wafer Assy, Inductance (Includes Switch)	p/o V-201 grid tuning w/L-201	713970
L-203	Same as L-202	p/o V-201 plate tuning w/L-204	--
L-204	Coil, RF	p/o V-201 plate tuning w/L-203	713851-02
L-205	Coil, RF	V-202A plate tuning	713851-03
L-206	Coil, RF	V-203 grid tuning	713851-04
L-207 thru L-210	Not Used		
L-211	Coil, RF	Develops MC crystal voltage	713852
L-212 thru L-213	Not Used		
L-214	Coil, KC oscillator	KC oscillator damping	713853-01
L-215	Not Used		
L-216	Not Used		
L-217	Coil, RF	p/o MC oscillator tuning w/L-218	713851-05
L-218	Coil, RF (Part of Z1)	p/o MC oscillator tuning w/L-217	Not replaceable
MP-201	Lamp Unit, Panel	Mounts I-201	701392-04

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
MP-202	Knob	Connects to shaft of R-231 (Marker Beacon Sensitivity Control)	713859-01
MP-203	Knob	Connects to shaft of R-241 (Squelch control)	713859-02
MP-204	Knob	Connects to shaft of R-248 (Volume control)	713859-03
MP-205	Knob	Frequency Selection (KC)	714851-01
MP-206	Knob	Frequency Selection (MC)	711670-06
P-201	Not Used		
P-202	Not Used		
P-203	Connector, Receptacle, 11 pin, Male	Connects Model 5611A to A +, B +, AGC, Marker Beacon Sensitivity Control pilot lamp, ground, Model 2374 control, audio out, interconnection of Model 5611A circuit. Mates w/J-203	S24028-P11
R-201	Resistor, Fixed, Composition; 100K ohms ± 10%, 1/2 w	V-201 grid return	S11012-104-K
R-202	Resistor, Fixed, Composition; 1 megohm ± 10%, 1/2 w	AGC series filter impedance	S11012-105-K
R-203	Resistor, Fixed, Composition; 18K ohms ± 10%, 1/2 w	p/o V-203 screen voltage divider w/R-210	S11012-183-K
R-204	Resistor, Fixed, Composition; 330K ohms ± 10%, 1/2 w	V-202A grid return	S11012-334-K
R-205	Resistor, Fixed, Composition; 220 ohms ± 10%, 1/2 w	V-202A screen voltage dropping	S11012-224-K
R-206	Resistor, Fixed, Composition; 1K ohm ± 10%, 1/2 w	V-202A plate voltage dropping	S11012-102-K
R-207	Resistor, Fixed, Composition; 10K ohms ± 10%, 1/2 w	Broadens band pass of L-206, C-212	S11012-103-K
R-208	Same as R-201	V-203 grid return	--
R-209	Resistor, Fixed, Composition; 47 ohms ± 10%, 1/2 w	V-203 cathode bias	S11012-470-K
R-210	Same as R-203	p/o V-203 screen voltage divider w/R-203	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-211	Same as R-206	V-203 plate voltage dropping	--
R-212	Resistor, Fixed, Composition; 8.2 K ohms ± 10%, 1/2 w	Broadens band pass of T-201	S11012-822-K
R-213	Same as R-201	V-204A grid return	--
R-214	Same as R-201	V-204A screen voltage dropping	--
R-215	Same as R-206	V-204A plate voltage dropping	--
R-216	Same as R-201	V-205A grid return	--
R-217	Resistor, Fixed, Composition; 100 ohms ± 10%, 1/2 w	V-205A cathode bias	S11012-101-K
R-218	Same as R-203	V-205A screen voltage dropping	--
R-219	Same as R-206	V-205A plate voltage dropping	--
R-220	Same as R-217	V-206A cathode bias	--
R-221	Not Used		
R-222	Same as R-206	V-206A plate voltage dropping	--
R-223	Resistor, Fixed, Composition; 470K ohms ± 10%, 1/2 w	p/o B + voltage divider w/R-224	S11012-474-K
R-224	Resistor, Fixed, Composition; 33K ohms ± 10%, 1/2 w	p/o B + voltage divider w/R-223	S11012-333-K
R-225	Resistor, Fixed, Composition; 4.7K ohms ± 10%, 1/2 w	p/o noise limiter voltage divider w/R-226	S11012-472-K
R-226	Resistor, Fixed, Composition; 22K ohms ± 10%, 1/2 w	p/o noise limiter voltage divider w/R-225	S11012-223-K
R-227	Same as R-202	p/o noise limiter AF voltage divider w/C-234	--
R-228	Same as R-205	Provides high impedance to AF in noise limiter circuit	--
R-229	Resistor, Fixed, Composition; 2.2 megohms ± 10%, 1/2 w	AGC load	S11012-225-K
R-230	Same as R-229	AGC series filter impedance	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-231	Resistor, Variable, Composition; 5K ohms ± 20%, 1/4 w	Marker Beacon Sensitivity Control	S11026-06
R-232	Not Used		
R-233	Same as R-207	p/o V-202B grid return voltage divider w/R-251	--
R-234	Same as R-207	V-204B grid return	--
R-235	Resistor, Fixed, Composition; 15K ohms ± 10%, 1 w	B + voltage dropping	S11013-153-K
R-236	Same as R-201	V-207 grid return, pin 7	--
R-237	Same as R-206	V-207 cathode bias, pin 8	--
R-238	Same as R-224	V-207 plate voltage dropping, pin 6	--
R-239	Resistor, Fixed, Composition; 6.8K ohms ± 10%, 1/2 w	Separates cathodes of V-207	S11012-682-K
R-240	Resistor, Fixed, Composition; 4.7 megohms ± 10%, 1/2 w	Coupling to V-207 grid, pin 2	S11012-475-K
R-241	Resistor, Variable, Composition; 2K ohms ± 20%, 1/4 w	Variable squelch control	S11026-07
R-242	Same as R-240	V-205B grid return	--
R-243	Resistor, Variable, Composition; 10K ohms ± 20%, 1/4 w	V-205B cathode follower	S11026-08
R-244	Resistor, Variable, Composition; 1K ohm ± 20%, 1/4 w	Variable squelch control	S11026-12
R-245	Resistor, Fixed, Composition; 82 ohms ± 10%, 2 w	Filament current bypass	S11014-820-K
R-246	Same as R-207		--
R-247	Same as R-201	AGC series filter impedance	--
R-248	Resistor, Variable, Composition; 50K ohms 1/4 w	Volume control	S11026-01
R-249	Resistor, Fixed, Composition; 2.7K ohms ± 10%, 1/2 w	V-204B plate voltage dropping	S11012-272-K
R-250	Same as R-225	V-202B plate voltage dropping	--
R-251	Resistor, Fixed, Composition; 10 ohms ± 10%, 1/2 w	p/o V-202B grid return voltage divider w/R-233	S11012-100-K

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-252	Resistor, Fixed, Composition; 150 ohms ± 10%, 1/2 w (Schematic 715052 B, C, D, E)	L-201 band broadening	S11012-151-K
R-253	Same as R-251	V-202B cathode bias (Schematic 715052 D, E)	--
S-201 A, B	Switch Wafer, Rotary (part of Z1)	S201A taps coil L-218	Not replaceable
		S-201B Selects crystals Y-201 thru Y-223	Not replaceable
S-202 A, B	Switch Wafer, Rotary	p/o Glide Slope channel selector system w/ S-203A, B, S-205A	713863
S-203 A, B	Switch Wafer, Rotary	p/o Glide Slope channel selector system w/ S-202A, B, S-205A	713861
S-204A	Switch Wafer, Rotary	Selects crystals Y-225 thru Y-244	713876
S-205A	Switch Wafer, Rotary	p/o Glide Slope channel selector system w/ S-202A, B, S-203A, B	714509
T-201	Transformer, IF	Couples output of V-203 to V-204A	713856
T-202	Transformer, IF	Couples output of V-204 to V-205A	713833
T-203	Same as T-202	Couples output of V-205A to V-206A	--
T-204	Same as T-202	Couples output of V-206A to V-206B	--
V-201	Electron Tube, 6BC5	RF amplifier	S12000-044
V-202	Electron Tube, 6U8	1st mixer, MC oscillator	S12000-013
V-203	Same as V-201	1st IF amplifier	--
V-204	Same as V-202	2nd mixer, KC oscillator	--
V-205	Same as V-202	2nd IF amplifier, navigation output amplifier	--
V-206	Same as V-202	3rd IF amplifier, Detector, AGC	--
V-207	Electron Tube, 12AT7	Squelch, Noise limiter	S12000-025

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
XV-201	Socket, Tube, 7 pin	Mounts V-201	S23006-7BMPG
XV-202	Socket, Tube, 7 pin	Mounts V-202	S23006-9BMPG
XV-203	Same as XV-201	Mounts V-203	--
XV-204	Same as XV-202	Mounts V-204	--
XV-205	Same as XV-202	Mounts V-205	--
XV-206	Same as XV-202	Mounts V-206	--
XV-207	Same as XV-202	Mounts V-207	--
Y-201	Crystal, Quartz; 88.00 MC	108-108.95 MC crystal See table 3-1	713636-57
Y-202	Crystal, Quartz; 89.00 MC	109-109.95 MC crystal See table 3-1	713636-58
Y-203	Crystal, Quartz; 90.00 MC	110-110.95 MC crystal See table 3-1	713636-59
Y-204	Crystal, Quartz; 91.00 MC	111-111.95 MC crystal See table 3-1	713636-60
Y-205	Crystal, Quartz; 92.00 MC	112-112.95 MC crystal See table 3-1	713636-61
Y-206	Crystal, Quartz; 93.00 MC	113-113.95 MC crystal See table 3-1	713636-62
Y-207	Crystal, Quartz; 94.00 MC	114-114.95 MC crystal See table 3-1	713636-63
Y-208	Crystal, Quartz; 95.00 MC	115-115.95 MC crystal See table 3-1	713636-64
Y-209	Crystal, Quartz; 96.00 MC	116-116.95 MC crystal See table 3-1	713636-85
Y-210	Crystal, Quartz; 97.00 MC	117-117.95 MC crystal See table 3-1	713636-86
Y-211	Crystal, Quartz; 98.00 MC	118-118.95 MC crystal See table 3-1	713636-87
Y-212	Crystal, Quartz; 99.00 MC	119-119.95 MC crystal See table 3-1	713636-88
Y-213	Crystal, Quartz; 100.00 MC	120-120.95 MC crystal See table 3-1	713636-89
Y-214	Crystal, Quartz; 101.00 MC	121-121.95 MC crystal See table 3-1	713636-90
Y-215	Crystal, Quartz; 102.00 MC	122-122.95 MC crystal See table 3-1	713636-91

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Y-216	Crystal, Quartz; 103.00 MC	123-123.95 MC crystal See table 3-1	713636-92
Y-217	Crystal, Quartz; 104.00 MC	124-124.95 MC crystal See table 3-1	713636-93
Y-218	Crystal, Quartz; 105.00 MC	125-125.95 MC crystal See table 3-1	713636-94
Y-219	Crystal, Quartz; 106.00 MC	126-126.95 MC crystal See table 3-1	713636-95
Y-220	Crystal, Quartz; 107.00 MC	127-127.95 MC crystal See table 3-1	713636-96
Y-221	Crystal, Quartz; 108.00 MC	128-128.95 MC crystal See table 3-1	713636-97
Y-222	Crystal, Quartz; 109.00 MC	129-129.95 MC crystal See table 3-1	713636-98
Y-223	Crystal, Quartz; 110.00 MC	130-130.95 MC crystal See table 3-1	713636-99
Y-224	Not Used		
Y-225	Crystal, Quartz; 16.90 MC	XXX.00 MC crystal See table 3-1	713636-65
Y-226	Crystal, Quartz; 16.95 MC	XXX.05 MC crystal See table 3-1	713636-66
Y-227	Crystal, Quartz; 17.00 MC	XXX.10 MC crystal See table 3-1	713636-67
Y-228	Crystal, Quartz; 17.05 MC	XXX.15 MC crystal See table 3-1	713636-68
Y-229	Crystal, Quartz; 17.10 MC	XXX.20 MC crystal See table 3-1	713636-69
Y-230	Crystal, Quartz; 17.15 MC	XXX.25 MC crystal See table 3-1	713636-70
Y-231	Crystal, Quartz; 17.20 MC	XXX.30 MC crystal See table 3-1	713636-71
Y-232	Crystal, Quartz; 17.25 MC	XXX.35 MC crystal See table 3-1	713636-72
Y-233	Crystal, Quartz; 17.30 MC	XXX.40 MC crystal See table 3-1	713636-73
Y-234	Crystal, Quartz; 17.35 MC	XXX.45 MC crystal See table 3-1	713636-74
Y-235	Crystal, Quartz; 17.40 MC	XXX.50 MC crystal See table 3-1	713636-75

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Y-236	Crystal, Quartz; 17.45 MC	XXX.55 MC crystal See table 3-1	713636-76
Y-237	Crystal, Quartz; 17.50 MC	XXX.60 MC crystal See table 3-1	713636-77
Y-238	Crystal, Quartz; 17.55 MC	XXX.65 MC crystal See table 3-1	713636-78
Y-239	Crystal, Quartz; 17.60 MC	XXX.70 MC crystal See table 3-1	713636-79
Y-240	Crystal, Quartz; 17.65 MC	XXX.75 MC crystal See table 3-1	713636-80
Y-241	Crystal, Quartz; 17.70 MC	XXX.80 MC crystal See table 3-1	713636-81
Y-242	Crystal, Quartz; 17.75 MC	XXX.85 MC crystal See table 3-1	713636-82
Y-243	Crystal, Quartz; 17.80 MC	XXX.90 MC crystal See table 3-1	713636-83
Y-244	Crystal, Quartz; 17.85 MC	XXX.95 MC crystal See table 3-1	713636-84
Z-1	Wafer Section and Coil (part of Z-2)	Selects crystals Y-201 thru Y-223 and taps L-218	715612
Z-2	Crystal Assy, MC Oscillator (Includes all MC crystals, mount, wafer assy and associated components)	Selects MC frequency	713968
Z-3	Crystal Assy, KC Oscillator (Includes all KC crystals, mount, wafer assy)	Modifies MC frequency	713860

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-2-	715051	RECEIVER, Model 5611A	1	
-1	713859	. KNOB	1	
		(ATTACHING PARTS)		
-2	S46000-H2C3	. SCREW	2	
		-----*-----		
-3	714871-01	. KNOB	1	
		(ATTACHING PARTS)		
-4	97519-02	. SCREW	2	
		-----*-----		
-5	710856	. MASK	1	
		(ATTACHING PARTS)		
-6	711853	. SCREW	2	
-7	91039-20	. 0 RING	2	
		-----*-----		
-8	711671	. DIAL	1	
		(ATTACHING PARTS)		
-9	AN505-2-3	. SCREW	3	
		-----*-----		
-10	714933	. SHIM	1	
-11	711670-06	. KNOB	1	
		(ATTACHING PARTS)		
-12	97519-02	. SCREW	2	
		-----*-----		
-13	713859-01	. KNOB	1	
		(ATTACHING PARTS)		
-14	S46000-H2C3	. SCREW	2	
		-----*-----		
-15	S36005-14	. SHIM	1	
-16	S36006-05	. WASHER, Bowed	1	
-17	S11026-07	. RESISTOR, Variable (Including lock washer and mounting nut)	1	
		(ATTACHING PARTS)		
-18	No Number	. LOCKWASHER	1	
-19	No Number	. NUT, Mounting	1	
		-----*-----		
	701392-04	. LAMPHOLDER (Including lock washer and mounting nut)	1	
		(ATTACHING PARTS)		
-20	712285	. NUT, Plain Hex	1	
-21	AN935-10L	. WASHER, Lock Spring	1	
		-----*-----		
-22	712286	. . SPACER, Lampholder	1	
-23	712287	. . SOCKET, Lampholder	1	
-24	712288	. . WASHER, Rubber, 7/16 ID by 11/16 OD by 3/32 in. thick	1	
-25	712289	. . CAP, Lampholder	1	
-26	97395	. LAMP, 14V	1	
-27	713859-02	. KNOB	1	
		(ATTACHING PARTS)		
-28	S46000-H2C3	. SCREW	2	
		-----*-----		
-29	S36005-14	. SHIM	1	
-30	S36006-05	. WASHER, Bowed	1	

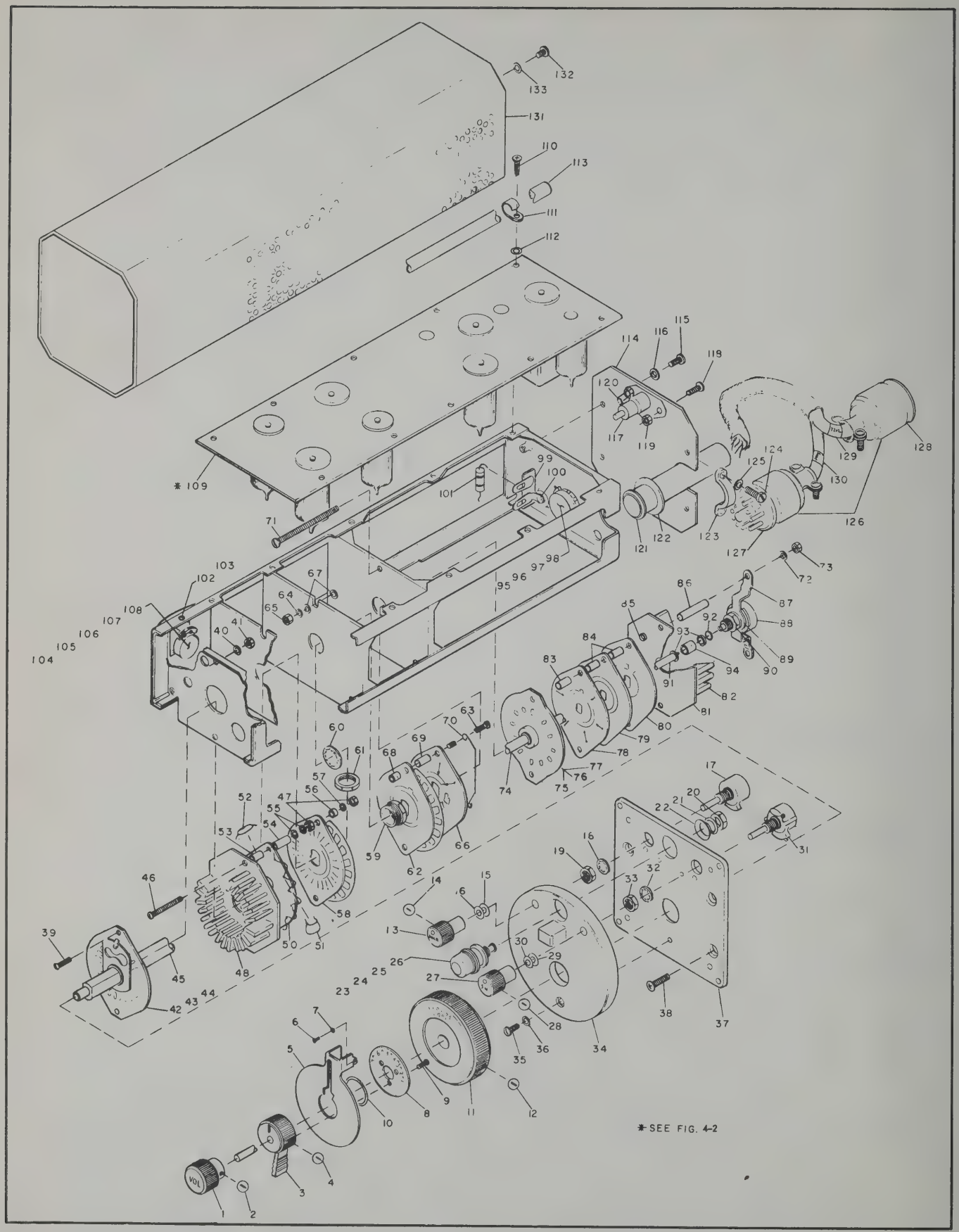

Figure II-2. Model 5611A Receiver, Exploded View

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-2-31	S11026-06	. RESISTOR, Variable (Including lock washer and mounting nut)	1	
		(ATTACHING PARTS)		
-32	No Number	. LOCKWASHER	1	
-33	No Number	. NUT, Mounting	1	
		-----*-----		
-34	711896-05	. PANEL, Round	1	
		(ATTACHING PARTS)		
-35	Q5413-02-06	. SCREW	1	
-36	91039-20	. O RING	1	
		-----*-----		
-37	713619	. PANEL, Mounting	1	
		(ATTACHING PARTS)		
-38	712915-02	. SCREW	4	
		-----*-----		
	713866	. . INDEX ASSEMBLY, MC	1	
		(ATTACHING PARTS)		
-39	Q5113-05-04	. . SCREW	2	
-40	AN935-5L	. . WASHER	2	
-41	S45002-03	. . NUT	2	
		-----*-----		
-42	AN216C2-12	. . . BEARING, Ball	1	
-43	63185-02	. . . RING, Retaining	1	
-44	713609	. . . PLATE	1	
-45	713868	. . . SHAFT	1	
	713968	. . CRYSTAL ASSEMBLY, MC Oscillator	1	
		(ATTACHING PARTS)		
-46	Q5113-05-18	. . SCREW	2	
-47	S45002-03	. . NUT	4	
		-----*-----		
-48	See chart	. . . CRYSTALS Y201 to Y223		
-49	713632	. . . BOARD, Printed Circuit, Crystal Mount	1	
-50	715612	. . . WAFER SECTION AND COIL	1	
-51	90732-01	. . . CAPACITOR	1	
-52	713852	. . . COIL	1	
-53	704887-11	. . SPACER	2	
-54	714809-02	. . SPACER	2	
-55	54001	. . WASHER	4	
-56	S34000-22	. . SPACER	2	
-57	AN935-5L	. . WASHER, Spring Lock	2	
-58	713970	. . WAFER, Inductance	1	
-59	713615	. . BUSHING, MC Shaft	1	
		(ATTACHING PARTS)		
-60	70768	. . WASHER, Internal Lock	1	
-61	13496	. . NUT, Hex	1	
		-----*-----		
-62	713970	. . WAFER, Inductance	1	
		(ATTACHING PARTS)		
-63	Q5113-05-14	. . SCREW	2	
-64	AN935-5L	. . WASHER, Spring Lock	2	
-65	S45002-03	. . NUT, Hex	2	
		-----*-----		
-66	713863	. . WAFER ASSEMBLY, Control (Unit MC)	1	
-67	54001	. . WASHER, Flat	4	
-68	714809-01	. . SPACER- .110	2	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-2-69	714809-02	. . SPACER-.250	2	
-70	715394	. . SPRING, SHAFT GROUND	1	
	713869	. . INDEX ASSEMBLY, Fractional MC	1	
		(ATTACHING PARTS)		
-71	Q5113-05-32	. . SCREW	2	
-72	AN935-5L	. . WASHER	2	
-73	S45002-03	. . NUT, Hex	2	
		-----*-----		
-74	713868	. . . SHAFT ASSEMBLY, Fractional MC	1	
-75	713609	. . . PLATE	1	
-76	63185-02	. . . RING, Retaining	1	
-77	AN216C2-12	. . . BEARING, Ball	1	
-78	713861	. . WAFER ASSEMBLY, Fractional MC	1	
-79	714509	. . WAFER ASSEMBLY, Stand By	1	
	713860	. . CRYSTAL ASSEMBLY, Fractional MC	1	
-80	713876	. . . WAFER		
-81	713632	. . . BOARD, Crystal Mount	1	
-82	See chart	. . . CRYSTALS Y225 thru Y243		
-83	704887-01	. . SPACER- 1/4"	2	
-84	704887-11	. . SPACER- 5/32"	4	
-85	S36002-005	. . WASHER, Nylon	2	
-86	60562-18	. . SPACER- 3/4"	2	
	713874	. . POTENTIOMETER ASSEMBLY, Bracket	1	
-87	713875	. . . BRACKET	1	
-88	S11026-01	. . . RESISTOR, Variable, 50K, 1/4W (Including lockwasher and mounting nut)	1	
		(ATTACHING PARTS)		
-89	No Number	. . . LOCKWASHER	1	
-90	No Number	. . . . NUT	1	
		-----*-----		
-91	713969	. . SHAFT, Volume Control	1	
-92	91039-17	. . . O RING	1	
-93	S36007-03C	. . . RING, Grip	2	
-94	S34000-22	. . . SPACER- 5/32"	1	
-95	S11026-08	. . . RESISTOR, Variable, 10K (Including lockwasher, nut and locknut)	1	
		(ATTACHING PARTS)		
-96	No Number	. . . LOCKWASHER	1	
-97	No Number	. . . NUT	1	
-98	No Number	. . . LOCKNUT	1	
		-----*-----		
-99	2750-H	. . . . TERMINAL BOARD	1	
		(ATTACHING PARTS)		
-100	4969	. . . . RIVET	1	
		-----*-----		
-101	S11014-820-M	. RESISTOR, 50K, 2W	1	
	No Number	. RESISTOR ASSEMBLY	1	
		(ATTACHING PARTS)		
-102	43700SC-4BP5	. SCREW	1	
-103	AN935-4L	. WASHER, Spring Lock	1	
		-----*-----		
-104	715151	. BRACKET, Resistor Mounting	1	
-105	S11026-12	. RESISTOR, Variable, 1K ohms, 1/4 W, R244 (Including nut, lockwasher and locknut)	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-2-		(ATTACHING PARTS)		
-106	No Number	. LOCKNUT.	1	
-107	No Number	. NUT.	1	
-108	No Number	. LOCKNUT.	1	
		-----*-----		
-109	713690-02	. BOARD ASSEMBLY (See Fig. 4-2).	1	
		(ATTACHING PARTS)		
-110	43700SC-4BDS	. SCREW.	10	
		-----*-----		
-111	714932	. LUG, Ground Type.	3	
-112	S36002-001	. WASHER, Nylon	3	
-113	S44018-02	. CABLE, Min Coax 50 ohms	14	
-114	713878-01	. PLATE, Rear Identification.	1	
		(ATTACHING PARTS)		
-115	43700SC-4BD5	. SCREW.	4	
-116	AN935-4L	. WASHER, Spring Lock	4	
		-----*-----		
-117	708356	. JACK, Shielded Antenna Connect	1	
		(ATTACHING PARTS)		
-118	Q6413-04-05	. SCREW.	2	
-119	S45001-440-1	. NUT.	2	
		-----*-----		
-120	S32000-02A	. LUG.	1	
-121	AN3420-8	. BUSHING	1	
-122	713727	. WASHER, Flat	1	
	No Number	. CABLE ASSEMBLY	1	
		(ATTACHING PARTS)		
-123	713795	. CLAMP, Cable	1	
-124	Q6513-06-08	. SCREW.	2	
-125	AN935-6L	. WASHER, Spring Lock	2	
		-----*-----		
-126	S24028-C24	. PLUG CAP	2	
-127	S24028-P11	. CONNECTOR, Plug	1	
-128	S24028-S11	. CONNECTOR, Socket	1	
-129	97541-24	. MARKER, Tab (J202)	1	
-130	97541-27	. MARKER, Tab (P203).	1	
-131	715148	. COVER.	1	
		(ATTACHING PARTS)		
-132	Q6413-04-05	. SCREW.	3	
-133	AN936A4	. WASHER, Internal Tooth Lock	3	
		-----*-----		

POWER SUPPLY MODEL 2355 PARTS LIST

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Series 301-399	Power Supply, Model 2355 A, B, C, D. (A-14V, B-28V, C-14V surge protected, D-28V surge protected) Part of LNC-100 System. Approx. 3" high x 4 5/8" wide x 7 1/2" long.	Supplies power requirements for LNC-100 System	713400*
C-301	Capacitor, Fixed, Ceramic Dielectric; 5/8 in. OD disc 0.01 uf min value, 500 wvdc	p/o Marker Beacon audio coupling to V-301 grid, pin 2, w/ R-301	90732-07
C-302	Capacitor, Fixed, Ceramic Dielectric; 3/4 in. OD disc 0.05 uf +30% -20%, 500 V max (Schematic 713401F) or Capacitor, Fixed, Ceramic Dielectric; 19/32 in. OD disc 0.02 uf min value, 500 wvdc (Schematic 713401G, H, J, K)	Grid coupling to V-301	90732-17 90732-08
C-303	Same as C-302 (0.05 uf value) (Schematic 713401F) (0.02 uf value) (Schematic 713401G, H, J, K)	V-301, pin 1 coupling to V-302. p/o V-301, pin 1 coupling to V-301, pin 7	--
C-304	Not Used		
C-305	Same as C-302 (0.05 uf value) (Schematic 713401F) or (0.02 uf value) (Schematic 713401G, H, J, K)	Coupling to V-303 grid	--
C-306	Same as C-302 (0.02 uf value)	V-302 V-303 screen bypass	--
C-307	Capacitor, Fixed, Ceramic Dielectric; 7/8 in. OD disc 0.005 uf min value, 2000 wvdc	Tunes T-302	90732-23
C-308	Capacitor, Fixed, Miniature Electrolytic; 60 uf + 100% -10%, 30 wvdc	p/o Microphone bias voltage filter w/R-312 R-317, C-320	S10003-60-30
C-309	Same as C-308 (Schematic 713401F) or Not Used (Schematic 713401G, H, J, K)	p/o filter w/R-318	--
C-310	Same as C-308 (Schematic 713401F, G, H, J) Capacitor, Fixed, Electrolytic; 50 uf + 150% -10%, 50 wvdc (Schematic 713401K)	p/o V-302, V-303 negative bias filter w/C-311	-- S10003-50-50

*-01, 14V; -02, 28V; -03, 14V, surge protected; -04, 28V, surge protected.

POWER SUPPLY MODEL 2355 PARTS LIST (cont)

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-311	Same as C-302 (0.05 uf value)	p/o V-302, V-303 negative bias filter w/C-310	--
C-312	Same as C-302 (0.05 uf value)	Coupling capacitor	--
C-313 A B C D	Capacitor, Fixed, Electrolytic; 50 uf, 50 uf, 325 wvdc; 40 uf, 40 uf, 150 wvdc, tol + 100% -10%	C-313A and B - p/o B + high pass filter w/L-302 C-313C and D - p/o 125V filter w/ R-323	S10020
C-314	Capacitor, Fixed, Ceramic Dielectric; 3/8 in. OD disc 680 uuf ± 20%, 500 wvdc	p/o high pass filter w/L-301, C-315 (Model 2355A, B); p/o high pass filter w/L-301 (Model 2355C, D)	708081-01
C-315	Same as C-314	p/o high pass filter W/L-301, C-314 (Model 2355A and B only)	--
C-316	Same as C-308	DC input storage capacitor	--
C-317	Capacitor, Fixed, Electrolytic; 500 uf + 40% - 10%, 15 wvdc (14V)	DC input storage capacitor	S10037-501-15
	Capacitor, Fixed, Electrolytic; 500 uf + 150% - 10%, 30 wvdc (28V)		S10039
C-318	Capacitor, Fixed, Paper Dielectric; 2 uf ±20%, 100 wvdc	DC input storage capacitor	S10032-02
C-319	Same as C-307	Modulated B + bypass	--
C-320	Same as C-301	p/o microphone bias voltage filter w/R-312, R-317, C-308	--
C-321	Same as C-301	Bypass capacitor	--
C-322	Same as C-301	Model 2374 Module B+ bypass	--
C-323	Same as C-301	Transmitter B + bypass	--
C-324	Same as C-301	Receiver B + bypass	--
C-325	Capacitor, Fixed, Ceramic Dielectric; 3/8 in. OD disc 0.001 uf min value, 500 wvdc	14V input filter	90732-03
C-326	Same as C-325	Q-301 base voltage filter	--
C-327	Same as C-325	14V input filter	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-328	Same as C-325	Q-302 base voltage filter	--
C-329	Capacitor, Fixed, Ceramic Dielectric; 3/8 in. OD disc 0.001 uf ± 20%, 1500 wvdc	Tunes secondary of T-301	90732-10
C-330	Same as C-301 (Schematic 713401F) or Same as C-302 (0.02 uf value) (Schematic 713401G, H, J, K)	Grid coupling to V-301, pin 7	-- --
C-331	Same as C-308	DC input storage capacitor	--
C-332 to C-350	Not Used		
C-351	Same as C-314	RF bypass	--
CR-301	Diode, IN1442	p/o V-302, V-303 negative bias ckt.	S12002-022
CR-302	Same as CR-301	p/o full wave rectifier w/CR-303, CR-304 CR-305	--
CR-303	Same as CR-301	p/o full wave rectifier w/CR-302, CR-304, CR-305	--
CR-304	Same as CR-301	p/o full wave rectifier w/CR-302, CR-303, CR-305	--
CR-305	Same as CR-301	p/o full wave rectifier w/CR-302, CR-303, CR-304	--
CR-306 thru CR-350	Not Used		
CR-351	Diode, IN1313		S12002-050
F-300 to F-350	Not Used		
F-351	Fuse, 4 Amps or Fuse, 8 Amps	Input voltage fuse (Model 2355B, D) Input voltage fuse (Model 2355A, C)	S21001-27 S21001-30
K-301	Relay	Transmit/Receive relay	S15004-01

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
L-301	Coil, RF	p/o high pass filter w/C-314, C-315	S17080
L-302	Coil, RF	p/o B + high pass filter w/C-313A, C-313B	S17058
Q-301	Transistor, 2N174	p/o Saturable-reactor transistor type DC-AC converter w/Q-302, primary of T-301	S12001-009
Q-302	Same as Q-301	p/o Saturable-reactor transistor type DC-AC converter w/Q-301, primary of T-301	--
Q-303 thru Q-350	Not Used		
Q-351	Transistor, CTP 1513 (Model 2355A and C)	p/o surge protect ckt	S12001-029
	or		
	Transistor, CTP 1512 (Model 2355B and D)		S12001-028
Q-352	Transistor, 2N414	p/o surge protect ckt	S12001-026
R-301	Resistor, Fixed, Composition; 100K ohms ± 10%, 1/2 w (Schematic 713401F)	p/o Marker Beacon audio coupling to V-301 grid, pin 2, w/C-301	S11012-104-K
	or		
	Resistor, Fixed, Composition; 47K ohms ± 10%, 1/2 w (Schematic 713401G, H, J, K)		S11012-473-K
R-302	Resistor, Fixed, Composition; 68K ohms ± 10%, 1/2 w (Schematic 713401F)	Receiver audio coupling to V-301 grid, pin 2	S11012-683-K
	or		
	Resistor, Fixed, Composition; 33K ohms ± 10%, 1/2 w (Schematic 713401G, H, J, K)		S11012-333-K
R-303	Same as R-302 (68K ohm value) (Schematic 713401F, G, H)	V-301 grid return, pin 2	--
	or		
	Resistor, Fixed, Composition; 470K ohms ± 10%, 1/2 w (Schematic 713401J, K)		S11012-474-K
R-304	Resistor, Fixed, Composition; 220K ± 10%, 1/2 w	V-301, pin 1, plate voltage dropping	S11012-224-K
R-305	Same as R-303	V-301 grid return, pin 7	--
R-306	Same as R-304	V-301, pin 6 plate voltage dropping	--

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-307	Same as R-304	p/o V-302 grid return ckt. w/R-327	--
R-308	Resistor, Fixed, Composition; 1200 ohms ± 10%, 1/2 w (Schematic 713401F, G, H, J, K)	V-301 cathode bias	S11012-122-K
R-309	Same as R-304	V-303 grid return	--
R-310	Resistor, Fixed, Wire Wound; 120 ohms ± 10%, 3 w (28V)	Transmitter/Receiver relay control voltage dropping (28V operation only)	707732-07
R-311	Resistor, Fixed, Composition; 47 ohms ± 10%, 1 w	Sidetone voltage dropping	S11013-470-K
R-312	Resistor, Fixed, Composition; 220 ± 10%, 1/2 w	p/o Microphone bias voltage filter w/R-317 C-308, C-320	S11012-221-K
R-313	Resistor, Fixed, Composition; 56K ± 5%, 1/2 w	p/o V-302, V-303 negative bias voltage divider w/R-314	S11012-563-J
R-314	Resistor, Fixed, Composition; 100K ± 5%, 1/2 w	p/o V-302, V-303 negative bias voltage divider w/R-313	S11012-104-J
R-315	Resistor, Fixed, Composition; 1K ohms ± 10%, 1/2 w (Schematic 713401F) or Not Used (Schematic 713401G, H, J, K)	CR-301 load	S11012-102-K
R-316	Same as R-314	V-302, V-303 negative bias load	--
R-317	Resistor, Fixed, Composition; 100 ohms ± 10%, 1/2 w (14V) (Schematic 713401F) or Same as R-312 (14V) (Schematic 713401G, H, J, K) or Resistor, Fixed, Composition; 270 ohms ± 10%, 1/2 w (28V) (Schematic 713401F) or Resistor, Fixed, Composition; 560 ohms ± 10%, 1/2 w (28V) (Schematic 713401G, H, J, K)	p/o Microphone bias voltage filter w/R-312 C-308, C-320	S11012-101-K -- S11012-271-K S11012-560-K

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-318	Same as R-317 (100 ohms value) (14V) (Schematic 713401F)	p/o filter w/C-309	--
	or		
	Same as R-317 (270 ohm value) (28V) (Schematic 713401F)	p/o filter w/C-309	--
	or		
	Not Used (Schematic 713401G, H, J, K)		
R-319	Resistor, Fixed, Composition; 1000 ohms ± 10%, 1/2 w (28V)	p/o Q-302, Q-303 base voltage developing resistor. Receive position only. (Model 2355R and D)	S11012-102-K
	or		
	Resistor, Fixed, Composition; 470 ohms ± 10%, 1/2 w (14V)	p/o Q-302, Q-303 base voltage developing resistor. Receive position only. (Model 2355A and C)	S11012-471-K
R-320	Resistor, Fixed, Composition; 18 ohms ± 10%, 1/2 w (14V) (Schematic 713401F)	p/o Q-301, Q-302 base voltage developing resistor	S11012-180-K
	or		
	Resistor, Fixed, Composition; 10 ohms ± 10%, 1/2 w (28V) (Schematic 713401F)		S11012-100-K
	or		
	Resistor, Fixed, Wire Wound; 3.9 ohms ± 10%, 1/2 w (14V and 28V) (Schematic 713401G, H, J, K)		702735-4
R-321	Same as R-317, (560 ohm value) (28V)	p/o Q-301, Q-302, Q-303 base voltage developing resistor. (Model 2355B and D)	--
	or		
	Resistor, Fixed, Composition; 270 ohms ± 10%, 1/2 w (14V)	p/o Q-301, Q-302 base voltage developing resistor. (Model 2355A and C)	S11012-271-K
R-322	Same as R-320 (3.9 ohm value) (14V) (Schematic 713401F)	p/o Q-301, Q-302 base voltage developing resistor	--
	or		
	Resistor, Fixed, Composition; 18 ohms ± 10%, 1/2 w (28V) (Schematic 713401F)		S11012-180-K
	or		
	Same as R-320 (10 ohms value) (14V and 28V) (Schematic 713401G, H, J, K)		
R-323	Same as R-310	p/o 125V dc high pass filter w/C-313C, C-313D.	--
R-324	Resistor, Fixed, Wire Wound; 40 ohms ± 10%, 3 w (28V)	V-301 filament shunt (Model 2355B and D)	707732-08

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-325	Resistor, Fixed, Composition; 100K ± 10%, 1 w	250V developing resistor	S11013-104-K
R-326	Same as R-302 (68K ohm value) (Schematic 713401F, G, H) or Same as R-302 (33K ohm value) (Schematic 713401J, K)	Aux. Receiver audio coupling to V-301 grid, pin 2.	-- --
R-327	Resistor, Fixed, Composition; 6800 ohms ± 10%, 1/2 w	p/o V-302 grid return ckt. w/R-307	S11012-682-K
R-328	Resistor, Fixed, Wire Wound; 270 ohms ± 10%, 3 w or Same as R-310	Model 2374 module B + voltage dropping (Model 2355A & C) Model 2374 module B + voltage dropping (Model 2355B and D)	707732-05 --
R-329 thru R-350	Not Used		
R-351	Resistor, Fixed, Composition; 150 ohms ± 10%, 1w	Line voltage dropping	S11013-151-K
R-352	Resistor, Fixed, Wire Wound; 330 ohms ± 5%, 3 w (28V)	Q-352 collector load	707732-16
	Resistor, Fixed, Wire Wound; 220 ohms ± 5%, 3 w (14V)		707732-17
R-353	Resistor, Fixed, Composition; 15K ohms ± 10%, 1/2 w	Base bias	S11012-153-K
	Resistor, Fixed, Composition; 27K ohms ± 10%, 1/2 w	Q-352 bias	S11012-273-K
R-354	Resistor, Fixed, Composition; 120 ohms ± 10%, 1/2 w	Q-352 bias	S11012-121-K
R-355	Resistor, Fixed, Composition; Selected (510-910 ohms) ±5%, 1/2 w or Resistor, Fixed, Composition; Selected (2000-3600 ohms) ± 5%, 1/2 w	Q-352 bias (Model 2355B, D) Q-352 bias (Model 2355A, C)	S11012-( )-K S11012-( )-K
R-356	Resistor, Fixed, Composition; 1800 ohms ± 10%, 1/2 w	Q-352 bias	S11012-182-K
RT-351	Resistor, Thermal, Composition; 1K ohm ± 10% @ 25°C B = 4000	Temperature compensating	S11030-H-102-K-07

POWER SUPPLY MODEL 2355 PARTS LIST (cont)

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
T-301	Transformer, Power (14V)	p/o Saturable-reactor transistor type DC-AC converter w/Q-301, Q-302; transforms 14V input to 260V output	S17054
	or		
	Transformer, Power (28V)	p/o Saturable-reactor transistor type DC-AC converter w/Q-301, Q-302; transforms 28V input to 260V output	S17055
T-302	Transformer, Output	Coupler V-302, V-303 output to transmitter and speaker	S17053
V-301	Electron Tube, 12AT7	Audio amplifier; phase inverter for V-303	S12000-029
V-302	Electron Tube, 12AB5	p/o push pull amplifier w/V-303	S12000-027
V-303	Same as V-302	p/o push pull amplifier w/V-302	

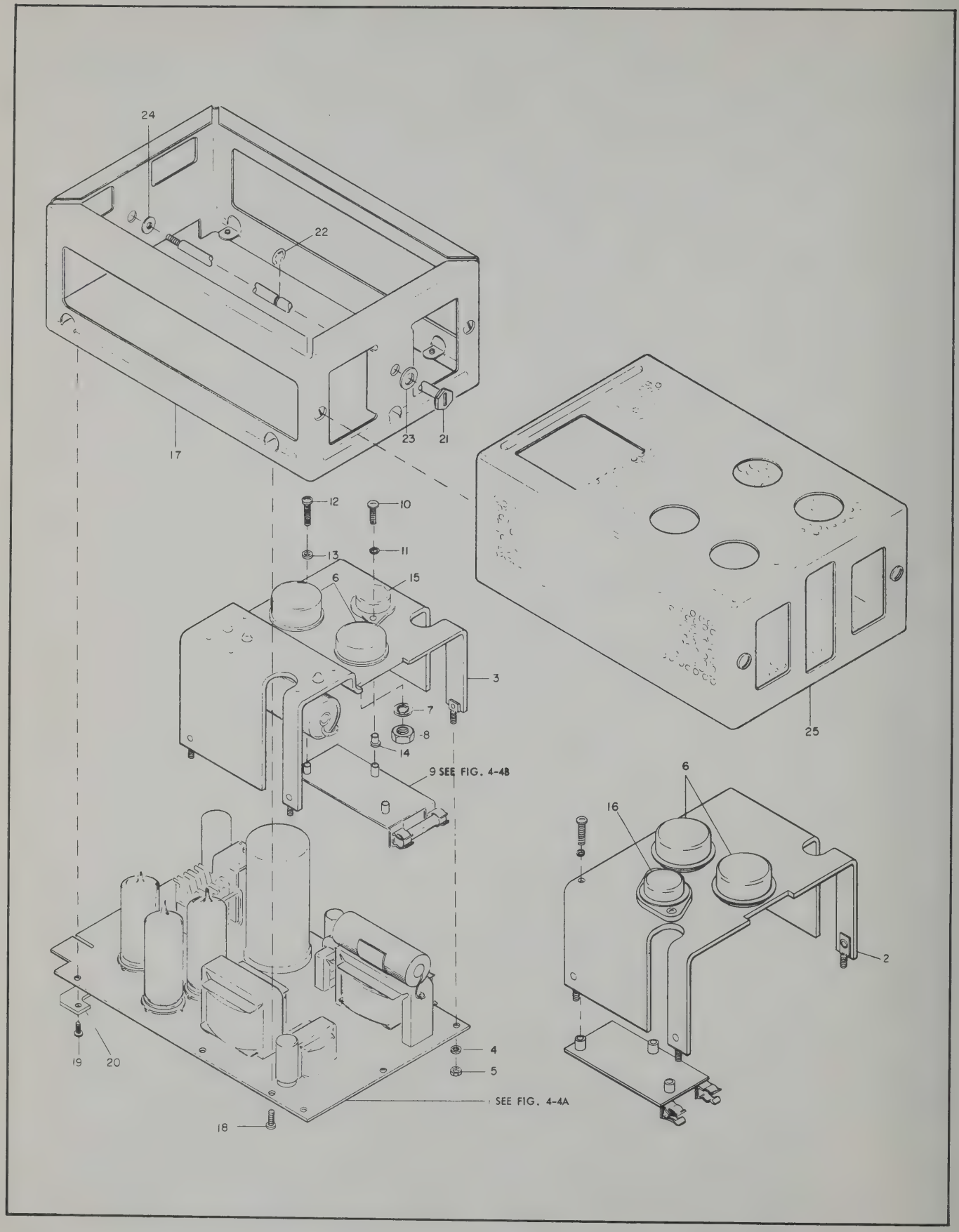

Figure II-3. Model 2355A Power Supply- Amplifier Modulator, Exploded View

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-3-	713400-01	POWER SUPPLY- AMPLIFIER MODULATOR Model 2355A	1	A
	713400-02	POWER SUPPLY- AMPLIFIER MODULATOR Model 2355B		B
	713400-03	POWER SUPPLY- AMPLIFIER MODULATOR Model 2355C		C
	713400-04	POWER SUPPLY- AMPLIFIER MODULATOR Model 2355D		D
	713674-01	. BOARD ASSEMBLY 14V (Including printed circuit, heat sink and associated components)	1	A
	713674-02	. BOARD ASSEMBLY 28V (Including printed circuit, heat sink and associated components)		B
	713674-03	. BOARD ASSEMBLY 14V Surge Protected (Including printed circuit, heat sink and associated components)		C
	713674-04	. BOARD ASSEMBLY 28V Surge Protected (Including printed circuit, heat sink and associated components)		D
-1	No Number	. . PRINTED CIRCUIT ASSEMBLY (See Fig. 4-4A)	1	
-2	713659	. . HEAT SINK (14V)	1	A
-3	714903	. . HEAT SINK (28V)		B
	715179-01	. . HEAT SINK ASSEMBLY (14V) Surge Protected		C
	715179-02	. . HEAT SINK ASSEMBLY (28V) Surge Protected		D
		(ATTACHING PARTS)		
-4	AN936A6	. . WASHER, Internal Tooth Lock #6	4	
-5	AN341-6	. . NUT, 6-32	4	
		-----*-----		
-6	S12001-009	. . TRANSISTOR 2N174	2	
		(ATTACHING PARTS)		
-7	AN936A10	. . WASHER, Internal Tooth Lock #10	2	
-8	AN341-10	. . NUT, 10-32	2	
		-----*-----		
-9	No Number	. . . PRINTED CIRCUIT ASSEMBLY, Surge Protector (Including Fuse Holder, Fuse and Associated components See Fig. 4-4B)	1	C, D
		(ATTACHING PARTS)		
-10	AN515PB4-8	. . . SCREW, 4-40	2	C, D
-11	AN935-4	. . . WASHER, Spring Lock #4	2	C, D
-12	Q5413-06-05	. . . SCREW, 6-32	1	C, D
-13	AN936A6	. . . WASHER, Tooth Lock #6	1	C, D
		-----*-----		
-14	715180	. . . INSERT, Nylon	2	C, D
-15	S12001-028	. . . TRANSISTOR, CTP 1512 (28V)	1	D
-16	S12001-029	. . . TRANSISTOR, CTP 1513 (14V)	1	C
-17	712578	. CHASSIS	1	
		(ATTACHING PARTS)		
-18	43700-SC4B6	. SCREW, Self-tapping	2	
-19	43700-SC4B3	. SCREW, Self-tapping	2	
		-----*-----		
-20	713119	. INSULATOR, Circuit Board	1	
-21	712545	. SCREW, Captive	1	
-22	S36001-10	. RING, Retaining	1	
-23	AN960-PD10	. WASHER, Flat	1	
-24	96510-51	. WASHER, Flat	1	
-25	715036	. COVER ASSEMBLY	1	

VOR-LOCALIZER-MARKER BEACON RECEIVER MODEL 2374 PARTS LIST

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
Series 401 499	VOR-Localizer-Marker Beacon Receiver Model 2374, 14V or 28V. Part of LNC-100 SYSTEM. Approx. 3" high x 7 1/2" wide x 9 1/2" long.	Consists of: VOR converter - two channel phase-sensitive amplifier for VOR signals. Localizer Converter Amplifier demodulator for localizer signals. Marker Beacon Receiver Fixed-TRF Receiver	713403
C-401 A, B, C	Capacitor, Fixed, Electrolytic; 40-40-40 uf + 100% -10%, 300 wvdc	A - p/o B + filter ckt w/R-402 B - p/o V-401B plate filter ckt w/R-424, C-401C; C - p/o V-401B plate filter ckt. w/R-424, C-401B.	S10029
C-402 A, B, C	Same as C-401	A - p/o V-405A plate filter ckt w/R-438, C-402B; B - p/o V-405A plate filter ckt w/R-438, C-402A; C - B + bypass	--
C-403	Capacitor, Fixed, Ceramic dielectric; 3/4 in. OD disc 0.05 uf + 80% -20%, 300 wvdc	p/o V-402A filter ckt w/R-403	90732-24
C-404	Capacitor, Fixed, Tubular; 0.1 uf ± 10%, 200 wvdc	VOR input coupling to V-401A	708197-42
C-405	Same as C-404	Localizer input coupling to V-404A	--
C-406	Capacitor, Fixed, Mica Dielectric; 15 uuf + 10%, 500 wvdc	Negative feedback from plate to grid of V-404A	705148-150KF
C-407	Capacitor, Fixed, Tubular; 47 uf ± 10%, 200 wvdc	V-404A coupling to 90/150 cycle filter	708197-50
C-408	Capacitor, Fixed, Tubular; 33 uf ± 10%, 200 wvdc	AGC decoupling w/R-410, R-412	709197-48
C-409	Capacitor, Fixed, Ceramic; 220 uuf ± 10%, N2200 p/o Z-406	Low pass filter w/R-411	
C-410	Capacitor, Fixed, Electrolytic; 100 uf + 100% -10%, 12 wvdc	V-404A cathode bypass	S10003-100-12
C-411	Same as C-404	V-404A screen bypass	--

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-412	Capacitor, Fixed, Ceramic; 51 uuf ± 5%, N080 p/o Z-404	V-402A coupling to V-402B	--
C-413	Capacitor, Fixed, Ceramic; 100 uuf ± 5%, N750 p/o Z-404	p/o Slope Detector	--
C-414	Capacitor, Fixed; Plastic Dielectric; 0.047 uf ± 20%, 400 wvdc	V-401A coupling to L-401	S10043-473-4M
C-415	Capacitor, Fixed; Ceramic; 180 uuf ± 5%, N2200 p/o Z-403	Tunes L-401	--
C-416	Capacitor, Fixed, Ceramic Dielectric; 5/16 in. OD disc 0.01 uf min value, 500 wvdc	V-407A coupling to V-404B	90732-07
C-417	Capacitor, Fixed, Tubular; 0.01 uf ± 10%, 200 wvdc	V-402A screen bypass	708197-30
C-418	Capacitor, Fixed, Mica Dielectric; 5100 uuf ± 20%, 300 wvdc	Slope detector RF bypass	708928-512GF
C-419	Capacitor, Fixed, Tubular; 0.27 uf ± 10%, 200 wvdc	DC blocking to V-401B grid network	708197-47
C-420	Same as C-403	RF bypass	--
C-421	Capacitor, Fixed, Plastic Dielectric; 0.1 uf ± 20%, 400 wvdc	p/o 150 cycle filter w/L-403	S10043-104-4M
C-422	Capacitor, Fixed, Plastic Dielectric; ± 20%, 100 wvdc	p/o 90 cycle filter w/L-404	S10043-154-1M
C-423	Same as C-404	Resolver rotor bypass	--
C-425	Not Used	Slope detector coupling to V-403	--
C-426	Capacitor, Fixed, Mica Dielectric; 4700 uuf ± 20%, 300 wvdc	p/o Slope Detector filter network w/R-416	708928-472GF
C-427	Capacitor, Fixed, Mica Dielectric; 470 uuf ± 10%, 300 wvdc	DC blocking	705148-F471K
C-428	Capacitor, Fixed, Paper Dielectric; 0.01 uf ± 10%, 100 wvdc	p/o low pass filter w/R-422	S10025-AS-103-F-1K
C-429	Same as C-404	RF bypass	--
C-430	Capacitor, Fixed, Tubular; 0.068 uf ± 10%, 400 wvdc	Resolver stator D bypass	708197-89
C-431	Same as C-430	V-405A coupling to V-405B	--
C-432	Same as C-430	Resolver stator F bypass	--

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-433	Capacitor, Fixed, paper Dielectric; 0.033uf ± 20%, 100 wvdc	p/o Resolver tracking network w/R-443, R-444	S10025-AG-333-T-1M
C-434	Capacitor, Fixed, Mica Dielectric; 5100 uuf ± 10%, 300 wvdc	p/o V-405A filter w/R-440	708928-512KF
C-435	Capacitor, Fixed, Plastic Dielectric; 0.27 uf ± 20%, 200 wvdc	Tunes -401 primary	S10043-274-2M
C-436	Capacitor, Fixed, Electrolytic; 10Z @ 30 cps	To-From meter smoothing	708189
C-437	Same as C-421	V-405B coupling to V-406 grid phase inversion ckt	--
C-438	Same as C-434	p/o phase shifting network w/R-448, R-432	--
C-439	Same as C-404	RF bypass	--
C-440	Same as C-435	Tunes T-402 primary	--
C-441	Same as C-407	p/o 90° phase shift network w/R-461, C-442	--
C-442	Same as C-407	p/o 90° phase shift network w/R-461, C-441	--
C-443	Same as C-436	R/L meter smoothing	--
C-444	Same as C-436	V-405B negative feedback to V-405A	--
C-445	Capacitor, Fixed, Ceramic Dielectric; 3/8 in OD disc 680 uuf ± 20%, 600 wvdc	V-407A plate bypass	708081-01
C-446	Capacitor, Fixed, Paper; 0.022 uf ± 20%, 200 wvdc	V-405B feedback to V-405A	S10025-AC-223-T2M
C-447	Capacitor, Fixed, Mica Dielectric; 15 uuf ± 10%, 500 wvdc	Coupling to V-407A grid	705148-150KF
C-448	Not used		

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
C-449	Capacitor, Fixed, Mica Dielectric; 10 uuf ± 10%, 500 wvdc	Tunes L-406	705148-100KF
C-450	Capacitor, Fixed, Mica Dielectric; 1000 uuf ± 10%, 500 wvdc	RF bypass	708928-102KF
C-451	Capacitor, Fixed, Ceramic Dielectric; 5/8 in OD disc 0.02 uf min value, 500 wvdc	V-407 filament bypass	90732-08
C-452	Same as C-449	Tunes L-407	--
C-453	Same as C-427	V-407B cathode bypass	--
C-454 to C-494	Not Used		
C-495	Capacitor, Fixed, Electrolytic; 60 uf +150% -10%, 25 wvdc (Model 2374 C1/D1 only)	p/o Marker Beacon input Voltage divider w/R-495, C-497 (Model 2374 C1/D1 only)	S1003-60-25
C-496	Capacitor, Fixed, Ceramic Dielectric; 0.01 uf, 500 wvdc (model 2374 C1/D1 only)	Q499 collector capacitor (Model 2374 C1/D1 only)	S10006-M-10000-H
C-497	Same as C-496	p/o Marker Beacon input Voltage Divider w/R-495, C-495 (Model 2374 C1/D1 only)	--
C-498	Capacitor, Fixed, paper Dielectric; 0.47 uf ± 20%, 100 wvdc (Model 2374 C1/D1 only)	Q-498 biass capacitor (Model 2374 C1/D1 only)	S10025AC-473-T-1-M
C-499	Same as C-496	Q-498 Bias Capacitor (Model 2374 C1/D1 only)	--
CR-401	Diode IN34A	Helps rectify To-From current	12002-004
CR-402	Not Used		
CR-403	Not Used		
CR-404	Same as CR-401	Helps rectify To-From current	
CR-405	Same as CR-401	Rectifies output from 150 cycle filter	--

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
CR-406	Same as CR-401	Rectifies output from 90 cycle filter	--
CR-407	Same as CR-401	p/o bridge rectifier network w/CR-408, CR-409, CR-410	--
CR-408	Same as CR-401	w/CR-407, CR-409, CR-410 rectifier network	--
CR-409	Same as CR-401	p/o bridge rectifier network w/CR-407, CR-408, CR-410	--
CR-410	Same as CR-401	p/o bridge rectifier network w/CR-407, CR-408, CR-409	--
CR-411	Same as CR-401	p/o bridge rectifier network w/CR-412, CR-413, CR-414	--
CR-412	Same as CR-401	p/o bridge rectifier network w/CR-411, CR-413, CR-414	--
CR-413	Same as CR-401	p/o bridge rectifier network w/CR-411, CR-412, CR-414	--
CR-414	Same as CR-401	p/o bridge rectifier network w/CR-411, CR-412, CR-413	--
E-401	Board, Marker Light, etched circuit. p/o EX-401 (Model 2374 C1/D1 only)	Mounts Marker Light components	714501
E-402	Board, VOR - Localizer, etched circuit	Mounts VOR-Localizer assembly components	713786
EX-401	Marker Light subassembly, etched ckt (Including Q-498, Q-499 and associated components) (Model 2374 C1/D1 only)	Marker Light circuit	714502
L-401	Coil, RF	V-402A grid tuning	707254
L-402	Same as L-401	p/o slope detector	--
L-403	Coil, AF	p/o 150 cycle filter w/C-421	707740
L-404	Coil, AF	p/o 90 cycle filter w/C-422	S17094
L-405	Not Used		

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
L-406	Coil, RF	RF Coupling V-407B to V-407A	707870
L-407	Coil, RF	Tunes in Marker Beacon frequency	707866
Q-498	Transistor-2N270 (Model 2374 C1/D1 only)	Determines when marker beacon light operates	S12001-015
Q-499	Transistor-2N268 (Model 2374 C1/D1 only)	Supplies current for marker beacon light	S12001-001
R-401	Resistor, Fixed, Composition; 3.3K ohms ± 10%, 1w	B + voltage dropping	S11013-332K
R-402	Same as R-401	p/o B + filter ckt w/C-401A	--
R-403	Resistor, Fixed, Composition; 27K ohms ± 10%, 1/2 w	p/o V-402A plate filter ckt w/C-403	S11012-273-K
R-404	Resistor, Fixed, Composition; 68K ohms ± 10%, 1/2 w, p/o Z-402	V-401 plate voltage dropping	--
R-405	Resistor, Fixed, Composition; 1 Meg ± 10% 1/2 w, p/o Z-402	V-401A amplitude clipping	--
R-406	Same as R-405	V-401A grid return	--
R-407	Resistor, Fixed, Composition; 680 ohms ± 10% 1/2 w, p/o Z-402	V-401A cathode bias	--
C-408	Resistor, Fixed, Composition; 39K ohms ± 10% 1/2 w, p/o Z-406	V-404A plate voltage dropping	--
R-409	Resistor, Fixed, Composition; 150K ohms ± 10% w, p/o Z-406	V-404A screen voltage dropping	--
R-410	Resistor, Fixed, Composition; 1 Meg ± 10% 1/2 w. p/o Z-406	V-404A gride return AGC decoupling w/R-412, C-408	--
R-411	Same as R-410	Low pass filter w/C-409	--
R-412	Resistor, Fixed, Composition; 4.7 Meg ± 10% 1/2 w. p/o Z-406	V-404 gride return, AGC decoupling w/R-410, C-408	--
R-413	Resistor, Fixed, Composition; 150 ohms ± 10%, 1/2 w	V-404A cathode biass	S11012-151K
R-414	Resistor, Fixed, Composition; 330K ohms ± 10%, 1/2 w, p/o Z-403	V-402A plate voltage dropping	--

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-415	Resistor, Fixed, Composition; 1 Meg ± 10% 1/2 w, p/o Z-403	V-402A screen voltage dropping	--
R-416	Resistor, Fixed, Composition; 1.8 Meg ± 10%, 1/2 w p/o Z-404 (Schematic 713404A thru E)	p/o slope detector filter network w/C-426	--
	OR		
	Resistor, Fixed, Composition; 1 Meg ± 10%, 1/2 w p/o Z-404 (Schematic 713404G, H)		--
R-417	Same as R-415	V-402A amplitude limiting	--
R-418	Resistor, Fixed, Composition; 2.2K ohms ± 10%, 1/2 w p/o Z-403	V-402A Cathode Bias	--
R-419	Resistor, Fixed, Composition; 1 Meg ± 10%, 1/2 w	V-404B grid return	S11012-105-K
R-420	Resistor, Fixed, Composition; 560 ohms ± 10%, 1/2 w	V-404B Cathode Bias	S11012-561-K
R-421	Resistor, Fixed, Composition; 4.7 Meg ± 10%, 1/2 w	p/o V-407A grid return w/R-468	S11012-475-K
R-422	Resistor, Fixed, Composition; 68K ohms ± 10%, 1/2 w (Schematic 713404 A thru D)	p/o low pass filter w/C-428	S11012-683-K
	OR		
	Resistor, Fixed, Composition; 220K ohms ± 10%, 1/2 w (Schematic 713404E, G, H)		S11012-224-K
R-423	Resistor, Fixed, Composition; 22K ohms ± 10%, 1/2 w	V-401B plate voltage dropping	S11012-223-K
R-424	Same as R-423	p/o V-401B plate filter ckt w/C-401B, C-401C	--
R-425	Resistor, Fixed, Composition; selected value	CR-405 load resistor	S11012
R-426	Resistor, Fixed, Composition; 470 ohms ± 5%, 1/2 w p/o Z-407	CR-405 load resistor	--
R-427	Resistor, Fixed, Composition; 180 ohms ± 5%, 1/2 w p/o Z-407	CR-405 and C-406 load resistor	--
R-428	Resistor, Variable; 250 ohms ± 30%, 1/2 w	CR-406 load resistor	707712-01
R-429	Resistor, Fixed, Composition; 330 ohms ± 5%, 1/2 w p/o Z-407	CR-406 load resistor	--
R-430	Resistor, Fixed, Composition; 2.2K ± 5%, 1/2 w	V-401B load resistor	S11012-222-J

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-431	Resistor, Fixed, Composition; 150K ohms ± 10%, 1/2 w (Schematic 713404A thru D) OR Resistor, Fixed, Composition; 270K ohms ± 10%, 1/2 w (Schematic 713404E, G, H)	V-401B grid return	S11012-154-K S11012-274-K
R-432	Resistor, Variable; 1 Meg ± 30%, 1/4 w	p/o phase shifting network w/R-448, C-438	707712-02
R-433	Resistor, Fixed, Composition; 1 Meg ± 10%, 1/2 w p/o Z-405	p/o phase inversion ckt; V-403A grid return	--
R-434	Resistor, Fixed, Composition; 470 ohms ± 10%, 1/2 w	To-From meter shunt (used only with a 4080 OBS)	S11012-471-K
R-435	Resistor, Fixed, Composition; 5.6 ohms ± 10%, 1/2 w p/o Z-405	p/o phase inversion ckt; keeps junction of R-433, R-436, R-437 above ground	--
R-436	Same as R-433	p/o phase inversion ckt; V-403B grid return	--
R-437	Resistor, Fixed, Composition; 220 ohms ± 10%, 1/2 w p/o Z-405 (Scnematic 713404A thru E) OR Resistor, Fixed, Composition; 390 ohms ± 10%, 1/2 w p/o Z-405 (Schematic 713404G, H)	V-402 cathode bias	-- --
R-438	Resistor, Fixed, Composition; 12K ohms ± 10%, 1/2 w	p/o V-405B + filter ckt w/C-402A, C-402B	S11012-123-K
R-439	Same as R-401	B + voltage dropping	--
R-440	Same as R-431 (270K value)	p/o V-405A grid filter w/C-434	--
R-441	Resistor, Fixed, Composition; 47K ohms ± 10%, 1/2 w p/o Z-408	V-405A plate voltage dropping	--
R-442	Same as R-441	V-405B plate voltage dropping	--
R-443	Resistor, Fixed, Composition; 150K ohms ± 1%, 1/2 w	V-405A grid return	S11020-1503
R-444	Resistor, Fixed, Compositiom; selected value	V-405A grid return	S11012-( )
R-445	Resistor, Fixed, Composition; 1.5K ohms ± 10%, 1/2 w p/o Z-408	V-405A cathode Bias	--

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-446	Resistor, Fixed, Composition; 1 Meg ± 10%, 1/2 w p/o Z-408	V-405B grid return	--
R-447	Same as R-445	V-405B cathode bias	--
R-448	Resistor, Fixed, Composition; 1.5 Meg ohm ± 10%, 1/2 w	p/o phase shifting network w/R-432, C-438	S11012-155-K
R-449	Resistor, Fixed, Composition; 220 ohms ± 10%, 1/2 w	R/L meter voltage dropping	S11012-221-K
R-450	Resistor, Fixed, Composition; 1.2K ohms ± 10%, 1/2 w	Phase comparator load	S11012-122-K
R-451	Resistor, Fixed, Composition; 1K ohms ± 10%, 1/2 w	To-From phase comparator load	S11012-102-K
R-452	Resistor, Fixed, Composition; 39 ohm ± 10%, 1/2 w	Flag meter shunt	S11012-390-K
R-453	Same as R-450	Phase comparator load	--
R-454	Same as R-451	Phase comparator load	--
R-455	Resistor, Variable; 500 ohm ± 30%, 1/2 w	Phase comparator load adjust	707712-03
R-456	Same as R-413	To-From meter shunt	--
R-457	Resistor, Fixed, Composition; 1 Meg ± 10%, 1/2 w p/o Z-409	p/o phase inversion ckt; V-406A grid return	--
R-458	Resistor, Fixed, Composition, 220 ohm ± 10%, 1/2 w p/o Z-409 (Schematic 713404A thru E)	V-406 cathode bias	--
	Resistor, Fixed, Composition; 390 ohm ± 10%, 1/2 w, p/o Z-409 (Schematic 713404G, H)	V-406 cathode bias	--
R-459	Same as R-457	p/o phase inversion ckt; V-406B grid return	--
R-460	Resistor, Fixed, Composition; 5.6K ohms ± 10%, 1/2 w p/o Z-409	p/o phase inversion ckt; Keeps junction of R-457 R-458, R-459 above ground	--
R-461	Resistor, Fixed, Composition; 6.8K ohms ± 10%, 1/2 w	p/o 90° phase shift network w/C-441, C-442	S11012-682K
R-462	Same as R-451	R/L meter shunt	--

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-463	Same as R-451	R/L meter shunt	--
R-464	Same as R-451	Flag meter shunt	--
R-465	Same as R-451	Flag meter shunt	--
R-466	Resistor, Fixed, Composition; 10K ohm ± 10%, 1/2 w	V-407A plate voltage dropping	S11012-103K
R-467	Resistor, Fixed, Composition; 2.2 Meg ± 10%, 1/2 w	V-407B AGC Series impedance	S11012-225K
R-468	Same as R-421	p/o V-407A grid return w/R-421	--
R-469	Resistor, Fixed, Composition; 202 Meg ± 10%, 1/2 w p/o Z-404	V-402 load resistor	--
R-470	Resistor, Fixed, Composition; 200 ohm ± 10%, 1/2 w	V-407B cathode bias	S11012-201-K
R-471	Resistor, Fixed, Wire Wound; 15 ohm ± 3%, 5 w	V-404 filament voltage dropping	S11006E-150-J
R-472	Resistor, Fixed, Wire Wound; 120 ohm ± 10%, 3 w (28V operation only)	K-401 voltage dropping (28V only)	707732-07
R-473	Resistor, Fixed, Composition; 390 ohm ± 10%, 1/2 w (Schematic 713404A thru D) OR Resistor, Fixed, Composition; selected value (Schematic 713404E, G, H)	Flag, To-From indicator voltage dropping Flag, To-From indicator voltage dropping	S11012-391-K S11012-( )
R-474	Same as R-473 (390 ohm value) (Schematic 713404A thru D) OR Same as R-473 (Selected value) (Schematic 713404E, G, H)	R/L meter voltage dropping R/L meter voltage dropping	-- --
R-475	Resistor, Fixed, Composition; 6.8 ohm ± 10%, 1/2 w	Voltage dropping	S11012-682-K
R-476	Resistor, Fixed, Composition; 15 ohm ± 10%, 1/2 w	V-407B harmonic suppression	S11012-150-K
R-477 to R-494	Not Used		
R-495	Resistor, Fixed, Wire Wound; 10 ohm ± 10%, 3 w (Model 2374 C1/D1 only)	p/o Marker Beacon input voltage divider w/C-495, C-497 (Model 2374 C1/D1 only)	707732-06

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
R-496	Resistor, Fixed, Composition; 56K ohm + 10%, 1/2 w (Model 2374 C1/D1 only)	Q-498 bias resistor (Model 2374 C1/D1 only)	S11012-563-K
R-497	Resistor, Fixed, Composition; 2.2K ohm + 10%, 1/2 w (Model 2374 C1/D1 only)	Q-498 bias resistor (Model 2374 C1/D1 only)	S11012-222-K
R-498	Resistor, Fixed, Composition; 3.3 ohm + 10%, 1 w (Model 2374 C1/D1 only)	Q-499 emitter resistor (Model 2374 C1/D1 only)	S11013-3R30-K
R-499	Resistor, Fixed, Composition; 22 ohm + 10%, 1/2 w (Model 2374 C1/D1 only)	Q-498 emitter resistor (Model 2374 C1/D1 only)	S11012-220-K
RT-499	Resistor, Fixed, Thermal; 2.7K ohm + 10%, (Model 2374 C1/D1 only)	Temperature sensitive bias regulator (Model 2374 C1/D1 only)	S11015-F-272-K-07
T-401	Transformer	Couples V-403 to phase comparator	S17093
T-402	Same as T-401	Couples V-406 to phase comparator	--
TP-401	Connector, Quick Disconnect	Helps connect Marker Light assy EX-401 to VOR-Localizer assembly	S32024-04
TP-402	Same as TP-401	Helps connect Marker light assy EX-401 to VOR-Localizer assembly	--
TP-403	Same as TP-401	Helps connect Marker Light Assy EX-401 to VOR-Localizer assembly	--
TP-404	Same as TP-401	Helps connect Marker Light Assy EX-401 to VOR-Localizer assembly	--
V-401	Tube, 12AU7	VOR input amplifier VOR variable channel cathode follower	S12000-030
V-402	Tube, 6AS8	VOR 9960 cycle amplifier, VOR AM demodulation	S12000-046
V-403	Tube, 12AT7	Push-Pull amplifier for reference 30 cycles	S12000-029
V-404	Tube 6U8	90/150 cycle freq. amplifier. Marker Beacon amplifier	12000-013

NUMBER SYMBOL	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
V-405	Tube; 12AX7	Variable phase 30 cycle amplifier. Variable phase 30 cycle amplifier.	12000-031
V-406	Same as V-403	Push-pull amplifier for variable 30 cycles	--
V-407	Same as V-404	Marker Beacon amplifier	--
XV-401	Socket, Electron Tube	Mounts V-401	707721
XV-402	Same as XV-401	Mounts V-402	707721
XV-403	Same as XV-401	Mounts V-403	--
XV-404	Same as XV-401	Mounts V-404	--
XV-405	Same as XV-401	Mounts V-405	--
XV-406	Same as XV-401	Mounts V-406	--
XV-407	Same as XV-401	Mounts V-407	--
Z-401	Not Used		
Z-402	Resistor Assembly	Mounts R-404, R-405, R-406, R-407	714979
Z-403	Resistor Assembly and Capacitor	Mounts C-415, R-414, R-415, R-417, R-418	707841
Z-404	Capacitor - Resistor Assembly	Mounts C-412, C-413, R-416, R-469	714812
Z-405	Resistor Assembly	Mounts R-433, R-435, R-436, R-437	707843
Z-406	Resistor Assembly and Capacitor	Mounts R-408, R-409, R-410, R-411, R-412, C-409	714969
Z-407	Resistor Assembly	Mounts R-426, R-427, R-429	714983
Z-408	Resistor Assembly	Mounts R-441, R-442, R-445, R-446, R-447	707846
Z-409	Same as Z-405	Mounts R-457, R-458, R-459, R-460	--

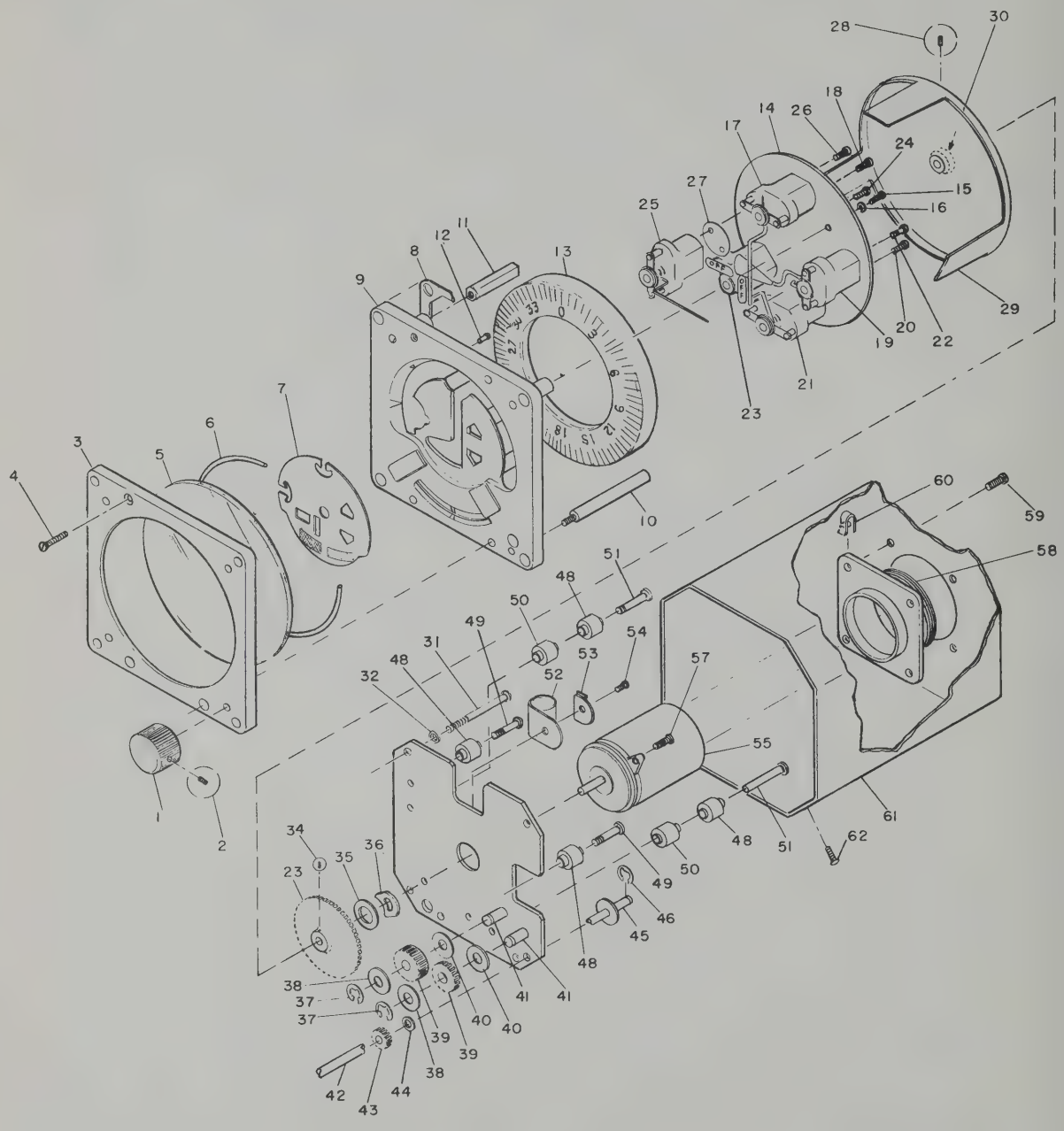

Figure II-4. Course Selector Assembly, Exploded View

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-4-	712278	COURSE SELECTOR ASSY.	1	
-1	712216-03	. KNOB	1	
		(ATTACHING PARTS)		
-2	AN56504H4	. SCREW, Set	2	
		-----*-----		
-3	709923	. BEZEL	1	
		(ATTACHING PARTS)		
-4	Q5527-04-04	. SCREW.	4	
		-----*-----		
-5	AN5727-5	. GLASS	1	
-6	708449	RING, Glass Retaining	1	
	712277	. MECHANISM ASSY- Selector Indicator	1	
-7	712272	. . MASK, Complete	1	
-8	709933	. . GASKET	1	
	709934	. . FRAME ASSY, Selector Indicator	1	
-9	709924	. . . FRAME, Selector Indicator	1	
-10	S34001-01	. . . SPACER.	1	
-11	S34003-04	. . . SPACER.	3	
-12	706754-02	. . . SPACER.	3	
-13	712269	. . DIAL, Complete	1	
-14	712274	. . PLATE, Mounting	1	
		(ATTACHING PARTS)		
-15	AN515-4-4	. . SCREW.	3	
-16	AN935-4L	. . WASHER, Spring Lock	3	
-17	709929-01	. . MECHANISM, Instrument	1	
		(ATTACHING PARTS)		
-18	Q3413-02-03	. . SCREW.	2	
		-----*-----		
-19	709930	. . MECHANISM, Instrument	1	
		(ATTACHING PARTS)		
-20	Q3413-02-03	. . SCREW.	2	
		-----*-----		
-21	712276	. . MECHANISM, Instrument	1	
		(ATTACHING PARTS)		
-22	Q3413-02-03	. . SCREW.	2	
		-----*-----		
-23	712275	. . MECHANISM, Instrument	1	
		(ATTACHING PARTS)		
-24	Q3413-02-03	. . SCREW.	2	
		-----*-----		
-25	709929-02	. . MECHANISM, Instrument	1	
		(ATTACHING PARTS)		
-26	Q3413-02-03	. . SCREW.	2	
		-----*-----		
-27	712271	. . SHIM	1	
	710657	. CLIP ASSY	1	
		(ATTACHING PARTS)		
-28	AN565D2H3	. SCREW.	2	
		-----*-----		
-29	709927	. . CLIP	1	
-30	710656	. . HUB	1	
	712266-01	. PLATE ASSY, Selector Indicator	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
II-4-		(ATTACHING PARTS)		
-31	AN515-6-4	. SCREW	3	
-32	AN935-6L	. WASHER	3	
		-----*-----		
-33	708381	. . GEAR	1	
		(ATTACHING PARTS)		
-34	AN565D2H3	. . SCREW, Set	2	
		-----*-----		
-35	27713-28	. . SHIM	1	
-36	709949	. . SPRING WASHER	1	
-37	97071-04-18	. . RING, Retaining	2	
-38	27713-21	. . SHIM	2	
-39	708415	. . GEAR, Spur	2	
-40	AN960C10L	. . WASHER	2	
-41	708364	. . SHAFT, Idler	2	
	708427-01	. . SHAFT ASSY	1	
-42	708365-01	. . . SHAFT	1	
-43	708416	. . . GEAR	1	
-44	708363-01	. . WASHER	1	
-45	708363-02	. . WASHER	1	
-46	97071-01-18	. . RING, Retaining	1	
-47	708375	. . PLATE, Mounting	1	
-48	708644	. . RESISTOR	4	
		(ATTACHING PARTS)		
-49		. . SCREW		
		-----*-----		
-50	708643	. . RESISTOR	2	
		(ATTACHING PARTS)		
-51		. . SCREW		
		-----*-----		
-52	701030-04	. . CLIP, Cable	1	
		(ATTACHING PARTS)		
-53	Q5413-04-03	. . SCREW	1	
-54	701031-01	. . WASHER, P1 Cable Clip	1	
		-----*-----		
-55	707704	. . RESOLVER, Electrical	1	
		(ATTACHING PARTS)		
-56	S33006-05	. . CLAMP, Synchro Mounting	2	
-57	Q5413-02-06	. . SCREW	2	
		-----*-----		
-58	702467-08	. RECEPTACLE	1	
		(ATTACHING PARTS)		
-59	Q5413-06-05	. SCREW	4	
-60	90712-06	. NUT	4	
		-----*-----		
-61	708378-02	. COVER	1	
		(ATTACHING PARTS)		
-62	AN505-2-3	. SCREW	2	
		-----*-----		

LNC-100A SHOCKMOUNT AND CONNECTOR KIT PARTS LIST

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
	Kit, Shockmount and Connector (LNC-100A)		714588-01
A-801	Shockmount	Mounts Power Supply unit	714010
J-101	Connector, Receptacle, 22 Pin, Female	Connects Transmitter to Power Supply and Dimmer Control. Mates w/P-101	S24028-S9
J-102 to J-202	Not Used		
J-203	Connector, Receptacle, 11 Pin, Female	Connects Receiver to Power Supply and Dimmer control. Mates w/P-203	S24028-S11
J-204 to J-300	Not Used		
J-301	Connector, Receptacle, 22 Pin, Female	Interconnection of Power Supply and other LNC-100A units. Mates w/P-301	S24000-22-01W
MP-101	Clamp, Cable	Holds J-101 to its cable	S24028-C24
MP-102 to MP-201	Not Used		
MP-202	Same as MP-101	Holds P-202 to its cable	--
MP-203	Same as MP-101	Holds J-203 to its cable	--
P-201	Not Used		
P-202	Connector, Plug, 11 Pin, Male	Allows for later addition of Nav Pac and Glideslope Receiver	S24028-P11

LNC-100B, LNC-100D* SHOCKMOUNT AND CONNECTOR KIT PARTS LIST

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
	Kit, Shockmount and Connector (LNC-100B)		714588-02
A-801	Not Used		
A-802	Shockmount	Mounts Power Supply and Nav Pac units	714009
J-101	Connector, Receptacle, 9 pin, Female	Connects Transmitter to Power Supply and Dimmer Control.	S24028-S9
J-102 to J-202	Not Used		
J-203	Connector, Receptacle, 11 Pin, Female	Connects Receiver to Nav Pac, Power Supply and Dimmer	S24028-S11
J-204 to J-300	Not Used		
J-301	Connector, Receptacle, 22 Pin, Female	Interconnection of Power Supply and other LNC-100B units. Mates w/P-301	S24000-22-01W
J-302 to J-400	Not Used		
J-401	Connector, Receptacle, 22 Pin, Female	Interconnection of New Pac and other LNC-100B units. Mates w/P-401	S24016-04VO
J-402 to J-600	Not Used		
J-601	Connector, Plug, 19 Pin, Female	Interconnection of Nav Pac with Model 4080 Indicator. Mates w/P-601	705184-02
J-602 to J-700	Not Used		
J-701	Same as J-601	Interconnection of Nav Pac with Model 4087 Indicator. Mates w/ P-701	--
MP-101	Clamp, Cable	Holds J-101 to its cable	S24028-C24

*Kit for LNC-100D consists of two LNC-100B Kits.

LNC-100B, LNC-100D* SHOCKMOUNT AND CONNECTOR KIT PARTS LIST (cont)

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
MP-102 to MP-201	Not Used		
MP-202	Same as MP-101	Holds P-202 to its cable	--
MP-203	Same as MP-101	Holds J-203 to its cable	--
P-201	Not Used		
P-202	Connector, Plug, 11 Pin, Male	Interconnection of 5611A Receiver with Glide-slope Receiver and Nav Pac	S24028-P11

*Kit for LNC-100D consists of two LNC-100B Kits.

LNC-100C SHOCKMOUNT AND CONNECTOR KIT PARTS LIST

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
	Kit, Shockmount and Connector (LNC-100C)		714588-03
A-801	Not Used		
A-802	Shockmount	Mounts Power Supply and Nav Pac units.	714009
A-803	Shockmount	Mounts Glideslope Receiver	714591
J-101	Connector, Receptacle, 9 Pin, Female	Connects Transmitter to Power Supply and Dimmer Control. Mates w/P-101	S24028-S9
J-102 to J-202	Not Used		
J-203	Connector, Receptacle, 11 Pin, Female	Connector Receiver to Nav Pac, Power Supply and Dimmer Control. Mates w/P-203	S24028-S11
J-204 to J-300	Not Used		
J-301	Connector, Receptacle, 22 Pin, Female	Interconnection of Power Supply and other LNC-100C units. Mates w/P-301	S24000-22-01W
J-302 to J-400	Not Used		
J-401	Connector, Receptacle, 22 Pin, Female	Interconnection of Nav Pac and other LNC-100C units. Mates w/P-401	S24016-04V0
J-402 to J-500	Not Used		
J-501	Connector, Receptacle, 28 Pin, Female	Interconnection of Glideslope Receiver and other LNC-100C units. Mates w/P-501	S24016-04M0
J-502 to J-700	Not Used		

LNC-100C SHOCKMOUNT AND CONNECTOR KIT PARTS LIST (cont)

SYMBOL NUMBER	DESCRIPTION	FUNCTION	MOTOROLA PART NUMBER
J-701	Connector, Plug, 19 Pin, Female	Interconnection of Model 4087 Indicator and Nav Pac, Glide-slope Receiver units. Mates w/P-701	705184-02
MP-101	Clamp, Cable	Holds J-101 to its cable	S24028-C24
MP-102 to MP-201	Not Used		
MP-202	Same as MP-101	Holds P-202 to its cable	--
MP-203	Same as MP-101	Holds J-203 to its cable	--
P-201	Not Used		
P-202	Connector, Plug, 11 Pin, Male	Interconnection of 5611A Receiver with Glide-slope Receiver and Nav Pac	S24028-P11

SUPPLEMENT

to

MAINTENANCE MANUAL

LNC-100

AIRCRAFT NAVIGATION AND COMMUNICATION SYSTEM

MOTOROLA AVIATION ELECTRONICS, INC.

10916 WEST WASHINGTON BLVD. CULVER CITY, CALIFORNIA, U.S.A.

LNC-100

MAINTENANCE MANUAL

SUPPLEMENT

1. The purpose of this supplement is fourfold. It is intended to correct errors in the LNC-100 Maintenance Manual; to describe circuit improvements made upon the subject equipment since publication of the maintenance manual; to discuss maintenance problems that have arisen; and to provide the customer with information for expanding the usefulness and versatility of the equipment.

2. Supplements to the LNC-100 manual will be issued in loose-leaf form with perforated margins. As additional information, pertinent to the LNC-100 system, is published, it may be inserted in the back of this supplement. In this way, the customer may avoid the loss of individual supplement sheets, and accumulate a complete set of information for convenient reference.

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ADDENDUM NO. 1
DWG NO. 715052
ISSUE F

SUBJECT: Model 5611A VHF Receiver

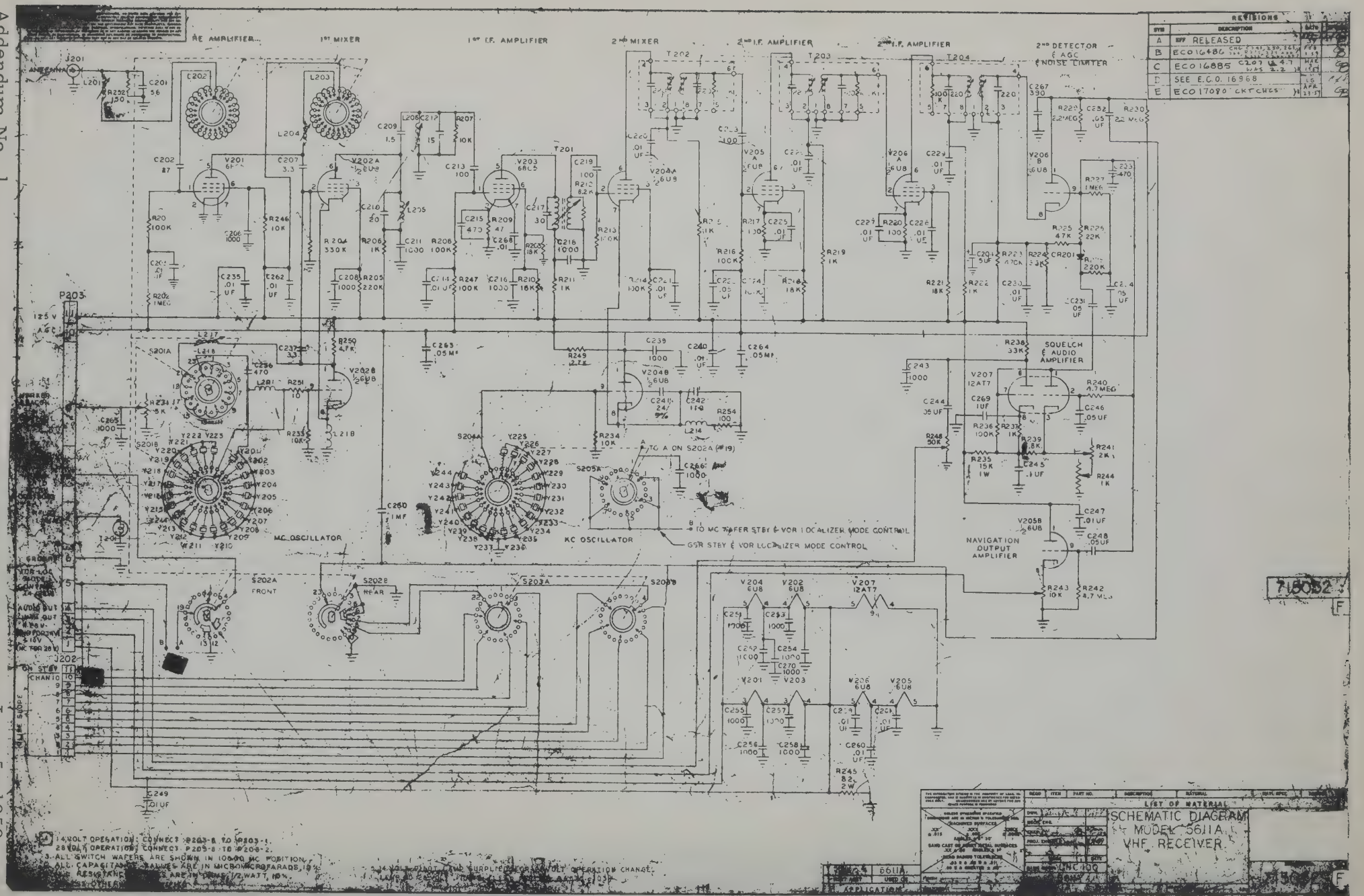
CHANGES:

1. The E issue of the model 5611A vhf receiver, see schematic 715052-E in Appendix I, employs grid injection from the plate of megacycle-oscillator V-202B to the grid of 1st mixer V-202A through coupling capacitor C-237.

   The F issue of the model 5611A vhf receiver, see accompanying schematic 715052-F, employs dual-injection from oscillator V-202B to 1st mixer V-202A. Grid injection as in the E issue of the model 5611A receiver remains the same. In addition, cathode-injection is employed to increase the level of the injected oscillator voltage at the low end of the frequency band. This is accomplished by providing a common ground return for the cathodes of oscillator V-202B and 1st mixer V-202A through inductance L-219.

2. Resistor R-254 in the cathode of Kilocycle Oscillator V-204B is increased in value from 100 ohms (issue E) to 150 ohms (issue F).

3. By-pass capacitor C-239 in the plate circuit of Kilocycle Oscillator V-204B is reduced in value from 1000 micro-microfarads to 100 micromicrofarads.


RF AMPLIFIER
1ST MIXER
1ST I.F. AMPLIFIER
2ND MIXER
2ND I.F. AMPLIFIER
2ND I.F. AMPLIFIER
2ND DETECTOR & AGC & NOISE LIMITER
SQUELCH & AUDIO AMPLIFIER
NAVIGATION OUTPUT AMPLIFIER
MC OSCILLATOR
KC OSCILLATOR
TO A ON S202A (#19)
TO MC WAFER STBY & VOR LOCALIZER MODE CONTROL
G5R STBY & VOR LOCALIZER MODE CONTROL
REVISIONS
SYM DESCRIPTION DATE APPD
A RFF RELEASED
B ECO16486
C ECO16885
D SEE E.C.O. 16968
E ECO17080 CKT CHGS
SCHEMATIC DIAGRAM
MODEL 561IA
VHF RECEIVER
LIST OF MATERIAL
APPLICATION
1. 14 VOLT OPERATION: CONNECT P203-8 TO P203-1.
28 VOLT OPERATION: CONNECT P205-8 TO P205-2.
3. ALL SWITCH WAFERS ARE SHOWN IN 108.00 MC POSITION.
4. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, 10%
RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%
OTHERS
14 VOLT OPERATION: CONNECT P203-8 TO P203-1.
28 VOLT OPERATION: CONNECT P205-8 TO P205-2.

ADDENDUM NO. 2
DWG NO. 715958
ISSUE A

SUBJECT: Model 5609B VHF Receiver

CHANGE:

1. The model 5609B vhf receiver is identical to the model 5611A (issue F) vhf receiver, with the following exceptions:

   a. All connector leads contain low-pass LC filter sections. Each filter section consists of a series r-f choke and a shunt feed-thru type capacitor.

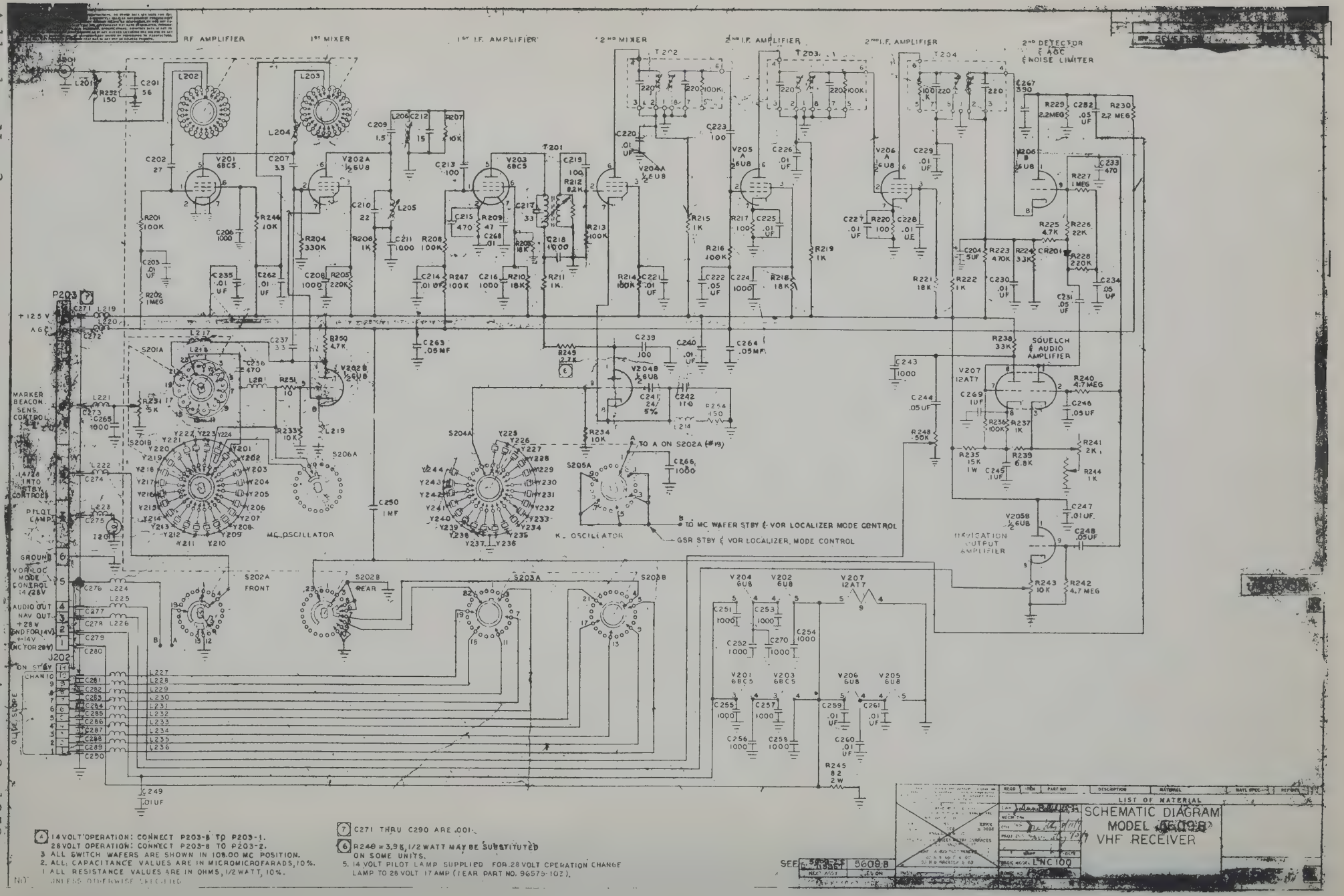
      Physically the additional filter components are mounted on a rear gusset-plate that affixes to the rear-end of the receiver with four mounting screws. External cable connections are soldered to the exposed terminals of the feed-thru capacitors that extend through the gusset-plate.

      Addition of the LC filter sections to the connector leads reduces the emission of radio-frequency energy between any two cable terminals, or between any cable terminal and ground to considerably less than 200 microvolts.

   b. The frequency range of the model 5609B vhf receiver has been extended from 108.0- to 130.9-mc to 108.0- to 131.9-mc by the addition of crystal Y-224. The extra crystal is switched into the circuit by means of additional wafer, S-206A, that is physically located between Megacycle Crystal Wafer S-201A and Megacycle Oscillator Inductance Wafer S-201B.

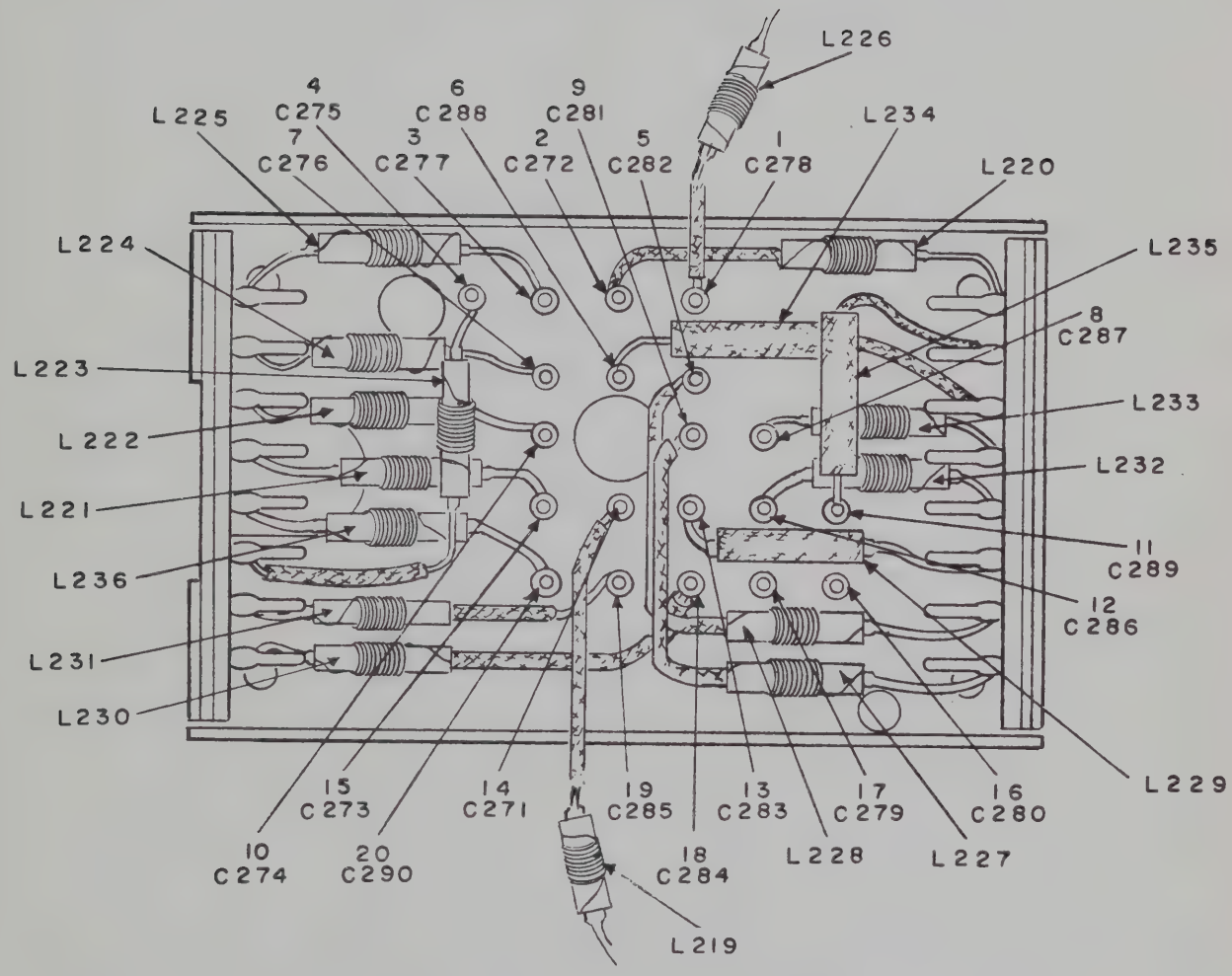
   c. Navigation Gain Potentiometer R-243 has been physically re-located from the rear-end plate of the receiver, and is now mounted on a bracket that is secured to the bottom right-hand side of the chassis frame approximately 1.75 inches forward from the rear-end plate.

   d. Squelch Level Control R-244 has been physically re-located from the rear-end of the receiver, and is now mounted on a bracket that is secured to the upper left-hand side of the chassis frame, directly behind the front panel.



4 14 VOLT OPERATION: CONNECT P203-8 TO P203-1.
28 VOLT OPERATION: CONNECT P203-8 TO P203-2.
3. ALL SWITCH WAFERS ARE SHOWN IN 108.00 MC POSITION.
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, 10%.
1 ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.
NOTE UNLESS OTHERWISE SPECIFIED

7 C271 THRU C290 ARE .001.
6 R248 = 3.9 K, 1/2 WATT MAY BE SUBSTITUTED ON SOME UNITS.
5. 14 VOLT PILOT LAMP SUPPLIED FOR 28 VOLT OPERATION CHANGE LAMP TO 28 VOLT 17 AMP (TEAR PART NO. 96575-102).



Component Layout Diagram
Rear Gusset Plate

SUPPLIMENTARY PARTS LIST

FOR MODEL 5609B VHF RECEIVER

REAR GUSSET PLATE

Symbol Number	Description	Function	Motorola Part No.	Qty. Per Equip
C-271	Capacitor, Feed Thru, Eyelet Type, 1000 uuf min. value	P/o RF filter w/L219	S10023-1000-K	20
C-272	Same as C-271	P/o RF filter w/L220	----	-
C-273	Same as C-271	P/o RF filter w/L221	----	-
C-274	Same as C-271	P/o RF filter w/L222	----	-
C-275	Same as C-271	P/o RF filter w/L223	----	-
C-276	Same as C-271	P/o RF filter w/L224	----	-
C-277	Same as C-271	P/o RF filter w/L225	----	-
C-278	Same as C-271	P/o RF filter w/L226	----	-
C-279	Same as C-271	RF bypass	----	-
C-280	Same as C-271	RF bypass	----	-
C-281	Same as C-271	P/o RF filter w/L227	----	-
C-282	Same as C-271	P/o RF filter w/L228	----	-
C-283	Same as C-271	P/o RF filter w/L229	----	-
C-284	Same as C-271	P/o RF filter w/L230	----	-
C-285	Same as C-271	P/o RF filter w/L231	----	-
C-286	Same as C-271	P/o RF filter w/L232	----	-
C-287	Same as C-271	P/o RF filter w/L233	----	-
C-288	Same as C-271	P/o RF filter w/L224	----	-
C-289	Same as C-271	P/o RF filter w/L235	----	-
C-290	Same as C-271	P/o RF filter w/L236	----	-
L-219	Coil, RF, 0.45 uh ± 4%	P/o RF filter w/C-271	701055-02	17
L-220	Same as L-219	P/o RF filter w/C-272	----	-
L-221	Same as L-219	P/o RF filter w/C-273	----	-
L-222	Same as L-219	P/o RF filter w/C-274	----	-
L-223	Coil, RF, 2.2 uh ± 10%	P/o RF filter w/C-275	S17033-09	1
L-224	Same as L-219	P/o RF filter w/C-276	----	-
L-225	Same as L-219	P/o RF filter w/C-277	----	-
L-226	Same as L-219	P/o RF filter w/C-278	----	-
L-227	Same as L-219	P/o RF filter w/C-281	----	-
L-228	Same as L-219	P/o RF filter w/C-282	----	-
L-229	Same as L-219	P/o RF filter w/C-283	----	-
L-230	Same as L-219	P/o RF filter w/C-284	----	-
L-231	Same as L-219	P/o RF filter w/C-285	----	-
L-232	Same as L-219	P/o RF filter w/C-286	----	-

Symbol Number	Description	Function	Motorola Part No.	Qty. Per Equip
L-233	Same as L-219	P/o RF filter w/C-287	----	-
L-234	Same as L-219	P/o RF filter w/C-288	----	-
L-235	Same as L-219	P/o RF filter w/C-289	----	-
L-236	Same as L-219	P/o RF filter w/C-290	----	-

SUBJECT: Ambient Temperature

The LNC-100 units must be installed in an area where ambient temperatures do not exceed 55°C. If there is any question about a proposed installation it is best to run an ambient temperature check using a Simpson Model 388-3L Therm-O-Meter or equivalent.

Place the equipment in the proposed area and set the aircraft in the direct sunlight. Tape the thermocouples about half way along the top of each unit to be installed. Operate all LNC units and adjacent equipment. Operate the equipment until the temperature stabilizes and note the temperature indications in the proposed installation.

If the ambient temperature does not exceed 55°C it is a safe installation. If the temperature is excessive consider the following means of reducing the ambient temperature.

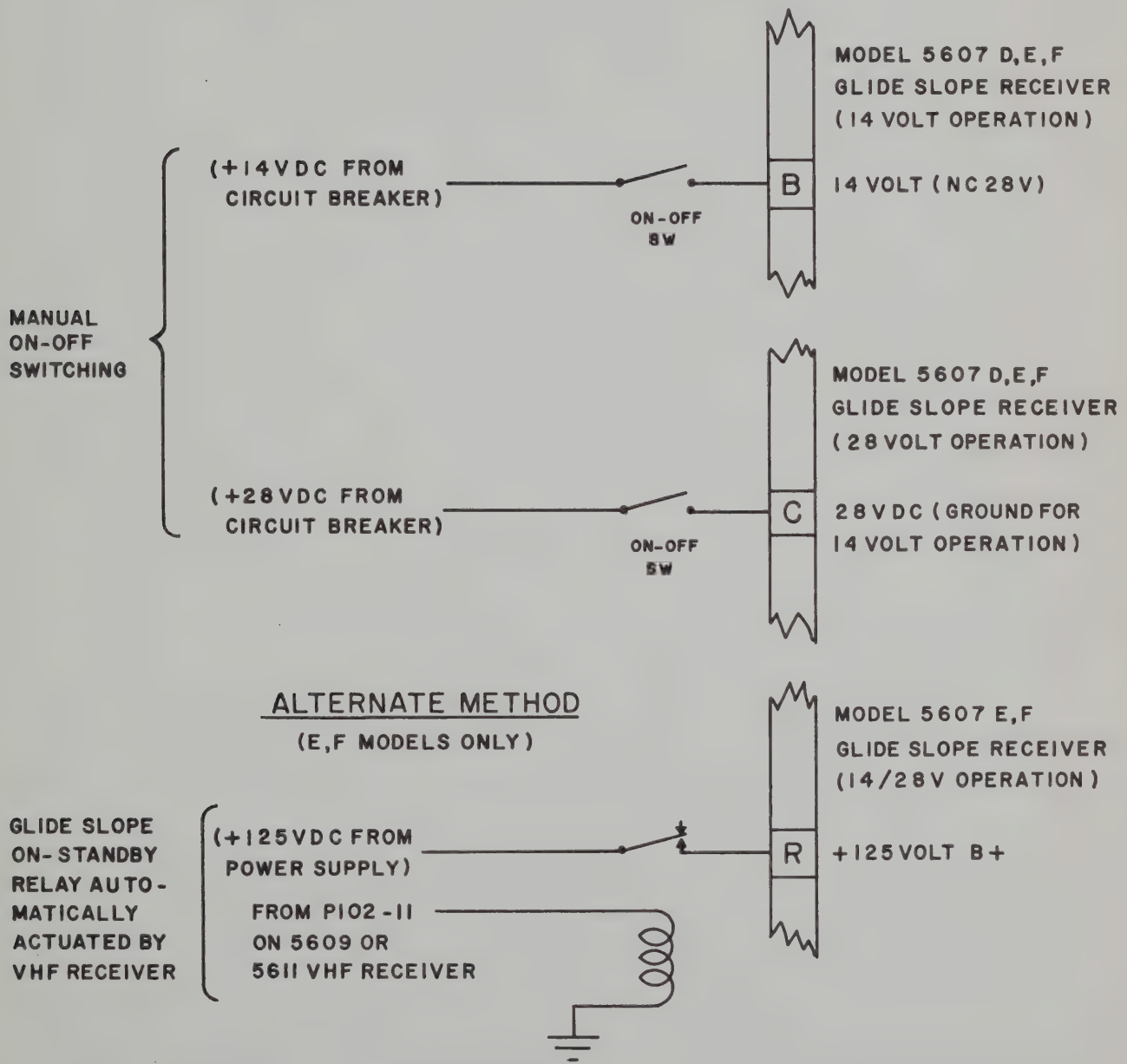
(1) Is there sufficient space around the units for natural convection air currents? If not, rearrange to allow for such air flow.

(2) Are there sufficient heat conductive paths for the equipment? Is the area insulated or closed to moving air? Remove heat insulation about the equipment and vent the area if possible.

(3) As a last resort in tight marginal installations, a blower can be installed to maintain air movement about the units.

SUBJECT: Manual ON-OFF Switching of Glideslope Receiver Models 5607 D, E, F.

Use one of the following methods to provide manual ON-OFF switching for the glide slope receiver.



SUBJECT: Model 2374 VOR Localizer

1. The circuit changes made on the Model 2374 VOR Localizer, issues J through Q, are listed below. All other changes are noted on schematic 703404S.

Issue	Items Affected	Changes Made
J	R476	Deleted.
K	R456	Deleted.
K	Pin Z of P401	Changed from "Spare" to "TO-FROM No. 2."
K	Pin 2 of P401	Changed from "B+ 250 volts" to "B+ 290 volts."
K	Pin B of P401	Changed from "+125 volts" to "+132 volts."
K	R438	Changed tolerance from 5% to 10%.
K	C456	Added.
K	C457	Added.
L	R422	Decreased resistance from 220K volts to 68K volts.
L	R431	Decreased resistance from 270K volts to 220K volts.
L	Pin X of P401	Changed from "Relay Control" to "VOR-LOC Transfer Relay".
M	R476	Added.
N	Pins F and Z of P401	Added damping capacitor across pins F and Z.
Q	C408	Deleted.
R	C410	Deleted.
R	C406	Deleted.
R	R413	Changed from 150 ohm to 100 ohms
R	V401	Changed from 12AU7 to 6680
R	V403	Changed from 12AT7 to 6679

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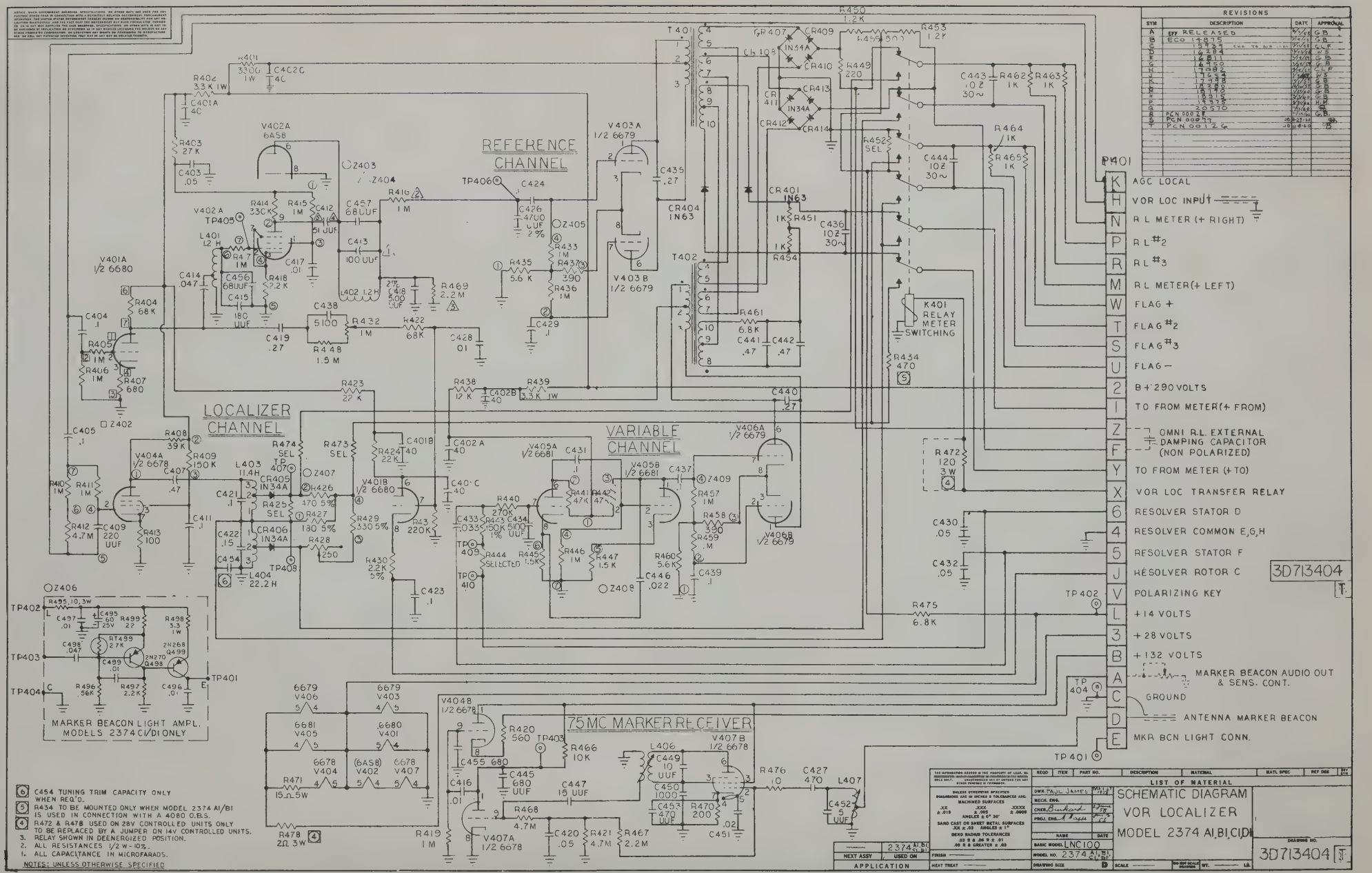
LNC-100 SYSTEM MANUAL

Issue	Items Affected	Changes Made
R	V404	Changed from 6U8 to 6678
R	V405	Changed from 12AX7 to 6681
R	V406	Changed from 12AT7 to 6679
R	V407	Changed from 6U8 to 6678
S	CR401, CR404	Changed from 1N34 to 1N63

SUPPLEMENTARY PARTS LIST

FOR MODEL 2374 VOR-LOC MARKER BEACON

Symbol No.	Part No.	Description
C456	705148-F-680-K	Capacitor, Fixed, Mica Dielectric; 68 uuf ± 10%, 500 wvdc
C457	---	Same as C456
CR401	S12002-005	Diode, 1N63
CR404		Same as CR401
K101	S15004-07	Relay
R413	S11012-101K	Resistor, Fixed, Composition; 100 ohms ± 10%, 1/2w
R422	S11012-683K	Resistor, Fixed, Composition; 68K ohms ± 10%, 1/2w
R438	S11012-123J	Resistor, Fixed, Composition; 12K ohms ± 5%, 1/2w
R476	S11012-100K	Resistor, Fixed, Composition; 10 ohms ± 10%, 1/2w
V101	S12000-063	Tube, 6680
V403	S12000-060	Tube, 6679
V404	S12000-062	Tube, 6678
V405	S12000-064	Tube, 6681
V406		Same as V403
V407		Same as V404


REFERENCE CHANNEL
LOCALIZER CHANNEL
VARIABLE CHANNEL
75MC MARKER RECEIVER
MARKER BEACON LIGHT AMPL. MODELS 2374CI/DI ONLY
K401 RELAY METER SWITCHING
P401
AGC LOCAL
VOR LOC INPUT
R L METER (+ RIGHT)
R L #2
R L #3
R L METER(+ LEFT)
FLAG +
FLAG #2
FLAG #3
FLAG —
B+290 VOLTS
TO FROM METER(+ FROM)
OMNI R.L. EXTERNAL DAMPING CAPACITOR (NON POLARIZED)
TO FROM METER (+ TO)
VOR LOC TRANSFER RELAY
RESOLVER STATOR D
RESOLVER COMMON E,G,H
RESOLVER STATOR F
RESOLVER ROTOR C
POLARIZING KEY
+14 VOLTS
+28 VOLTS
+132 VOLTS
MARKER BEACON AUDIO OUT & SENS. CONT.
GROUND
ANTENNA MARKER BEACON
MKR BCN LIGHT CONN.
3D713404
REVISIONS
SCHEMATIC DIAGRAM
VOR LOCALIZER
MODEL 2374 AI,BI,CI,DI
LIST OF MATERIAL
DRAWING NO. 3D713404
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL CAPACITANCE IN MICROFARADS.
2. ALL RESISTANCES 1/2 W - 10%.
3. RELAY SHOWN IN DEENERGIZED POSITION.
4 R472 & R478 USED ON 28V CONTROLLED UNITS ONLY TO BE REPLACED BY A JUMPER ON 14V CONTROLLED UNITS.
5 R434 TO BE MOUNTED ONLY WHEN MODEL 2374 AI/BI IS USED IN CONNECTION WITH A 4080 O.B.S.
6 C454 TUNING TRIM CAPACITY ONLY WHEN REQ'D.

ADDENDUM NO. 6
DWG NO. 713401
ISSUE X

SUBJECT: Model 2355 Power Supply Modulator

1. The circuit changes made on the Model 2355 Power Supply Modulator, issues L through V, are listed below. All other changes are noted on schematic 713401X.

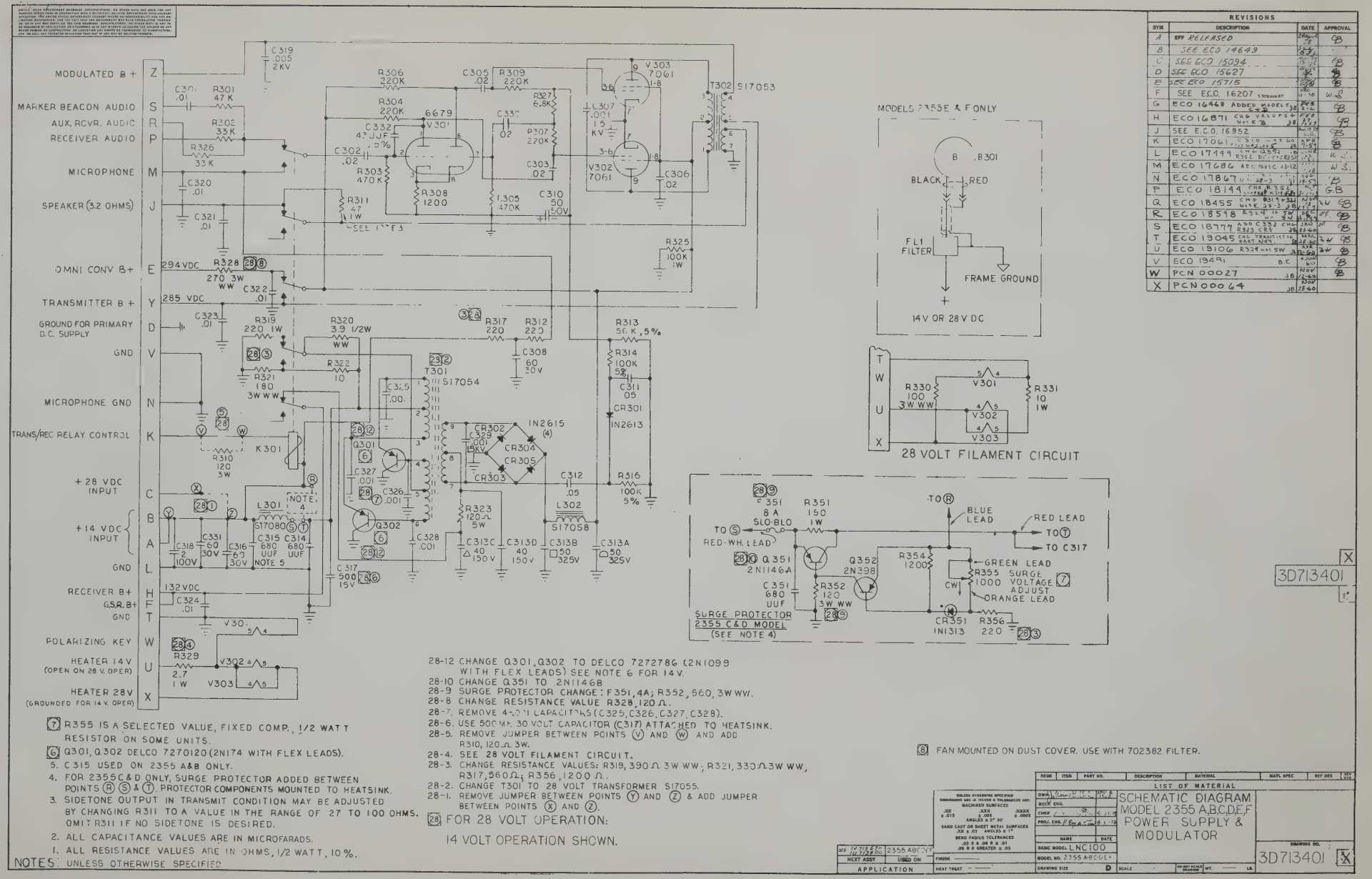
Issue	Items Affected	Changes Made
L	Q352	Replaced by 2N414
L	R353	Deleted.
N	R355	Changed selected value resistor to 1000-ohm pot.
P	R352	Decreased resistance from 330 ohms to 120 ohms
P	R314	Changed tolerance from 10% to 5%.
R	CR301	Replaced by 1N2613
R	12AT7	Changed to type 6679
R	12AB5	Changed to type 7061
R	CR302, CR303, CR304, CR305	Replaced by 1N2615
S	C332	Added.
S	R323	Changed wattage rating from 3 to 5 watts.
S	RT351	Deleted
S	R354	Increased resistance from 120 ohms to 1200 ohms.
T	Q351	Replaced by 2N1146A.
V	Blower B301	Added for Models 2355 E and F only.
W	R329	Added to filament circuit.
W	R330	Added to filament circuit.
W	R331	Added to filament circuit.
X	K301	Part Number Change.

SUPPLEMENTARY PARTS LIST

FOR MODEL 2355 POWER SUPPLY-MODULATOR

Symbol No.	Part No.	Description
C332	705148-430JF	Capacitor, Fixed; 43 uuf ± 5%
CR301	S12002-022	Diode, 1N1442
CR302	S12002-086	Diode, 1N2615
CR303	---	Same as CR302
CR304	---	Same as CR302
CR305	---	Same as CR302
K301	S15004-07	Relay, 14V
Q301	S12001-009	Transistor, Delco 7270120 (2N174 with leads) (A, B, and C Models)
Q302	---	Same as Q301
Q351	S12001-029	Transistor, 2N1146A (CTP1513)
Q352	S12001-026	Transistor, 2N414
R314	S11012-104J	Resistor, Fixed, Composition; 100K ohms ± 5%, 1/2w
R319	707732-20	Resistor, Fixed, Wirewound; 390 ohms (28 v)
R321	707732-16	Resistor, Fixed, Wirewound; 330 ohms (28 v)
R323	S11042-121J	Resistor, Fixed, Wirewound; 120 ohms ± 5%, 5w
R329	S11013-2R7K	Resistor, Fixed Composition 2.7 ohms ± 10%, 1w
R330	S11040-101K	Resistor, Wirewound; 100 ohms ± 10%, 3w
R331	S11013-010K	Resistor, Fixed Composition, 10 ohms ± 10%, 1w
R352	707732-07	Resistor, Fixed, Wirewound; 120 ohms 3w (D Models)
R354	S11012-122K	Resistor, Fixed, Composition; 1200 ohms ± 10%, 1/2w

Symbol No.	Part No.	Description
R355	S11026-12	Resistor, Variable; 1000 ohms (C and D Models)
R356	S11012-221K	Resistor, Fixed, Composition; 220 ohms ± 10%, 1/2w
V301	S12000-060	Tube, 6679
V303	S12000-061	Tube, 7061



REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	EFF RELEASED	2-Dec-59	GB
B	SEE ECO 14649	10-Feb-60	
C	SEE ECO 15094	25-Feb-60	GB
D	SEE ECO 15627	28-Mar-60	GB
E	SEE ECO 15715	28-Mar-60	GB
F	SEE ECO 16207 SCHEMATIC	11-May-60	WS
G	ECO 16448 ADDED MODELS C & D	28-Feb-60	GB
H	ECO 16871 CHG VALUES NOTE 3	28-Apr-60	GB
J	SEE E.C.O. 16952	5-May-60	GB
K	ECO 17061 C310 → 35 60 NOTE 2	28-May-60	GB
L	ECO 17499 CHG C352 R352 DELETED	2-Jun-60	WS
M	ECO 17686 ADD NOTE 12	17-Jun-60	WS
N	ECO 17867 NOTE 2&3	28-Jun-60	GB
P	ECO 18144 CHG R335	19-Jul-60	GB
Q	ECO 18455 CHG R314+331 NOTE 2&3	28-Jul-60	GB
R	ECO 18598 R324 → 5W	28-Jul-60	GB
S	ECO 18777 ADD C332 CHG R323 CR8	28-Aug-60	GB
T	ECO 19045 CHG TRANSISTOR PART NUMS	28-Sep-60	GB
U	ECO 19106 R324 WAS 5W	28-Sep-60	GB
V	ECO 19491 B.E.	4 JAN 60	GB
W	PCN 00027	NOV	GB
X	PCN 00064	NOV 28-60	

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3. SIDETONE OUTPUT IN TRANSMIT CONDITION MAY BE ADJUSTED BY CHANGING R311 TO A VALUE IN THE RANGE OF 27 TO 100 OHMS. OMIT R311 IF NO SIDETONE IS DESIRED.
4. FOR 2355 C&D ONLY, SURGE PROTECTOR ADDED BETWEEN POINTS (R) (S) & (T). PROTECTOR COMPONENTS MOUNTED TO HEATSINK.
5. C315 USED ON 2355 A&B ONLY.
6. Q301, Q302 DELCO 7270120 (2N174 WITH FLEX LEADS).
7. R355 IS A SELECTED VALUE, FIXED COMP., 1/2 WATT RESISTOR ON SOME UNITS.

28-1. REMOVE JUMPER BETWEEN POINTS (Y) AND (Z) & ADD JUMPER BETWEEN POINTS (X) AND (Z).
28-2. CHANGE T301 TO 28 VOLT TRANSFORMER S17055.
28-3. CHANGE RESISTANCE VALUES: R319, 390Ω 3W WW; R321, 330Ω 3W WW, R317, 560Ω; R356, 1200Ω.
28-4. SEE 28 VOLT FILAMENT CIRCUIT.
28-5. REMOVE JUMPER BETWEEN POINTS (V) AND (W) AND ADD R310, 120Ω 3W.
28-6. USE 500MF, 30 VOLT CAPACITOR (C317) ATTACHED TO HEATSINK.
28-7. REMOVE 4 [illegible] CAPACITORS (C325, C326, C327, C328).
28-8. CHANGE RESISTANCE VALUE R328, 120Ω.
28-9. SURGE PROTECTOR CHANGE: F351, 4A; R352, 560, 3W WW.
28-10. CHANGE Q351 TO 2N1146B
28-12. CHANGE Q301, Q302 TO DELCO 7272786 (2N1099 WITH FLEX LEADS) SEE NOTE 6 FOR 14V.

28 FOR 28 VOLT OPERATION:
14 VOLT OPERATION SHOWN.

8 FAN MOUNTED ON DUST COVER. USE WITH 702382 FILTER.

REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES

LIST OF MATERIAL

SCHEMATIC DIAGRAM MODEL 2355 A,B,C,D,E,F POWER SUPPLY & MODULATOR

DRAWING NO. 3D713401 X

3D713401 X

USE ON 11/28/60	2355 ABCDEF
NEXT ASSY	USED ON
APPLICATION	

BASIC MODEL LNC100
MODEL NO. 2355 ABCDEF
DRAWING SIZE D
SCALE
WT. LB.

SUBJECT: Blower Motor Maintenance for Model 2355 Power Supply Modulator.

1. The procedure for proper maintenance of the blower motor (B301) is as follows.

   (a) Inspect brushes every 200 hours; replace as necessary.

   (b) Inspect bearings every 500 hours; replace as necessary.

   (c) Inspect the blower motor mounting security, power leads and suppressor mounting every 1000 hours; repair as necessary.

ADDENDUM NO. 7

SUBJECT: Model 5611A VHF Receiver

CHANGES: Alignment Procedure (Page 50, Section 4)

NEW PROCEDURE:

4.11.2 Alignment of Megacycle and Tenth-Megacycle Oscillators

a. Connect the input of the VTVM through a 100K isolating resistor to pin 9 of the unit megacycle oscillator tube, V202B.

b. Set the VTVM to the -3 volt d-c range.

c. Set the receiver tuning dial to the highest frequency of operation.

d. Adjust the core of L-217 for maximum indication on the VTVM. The VTVM reading depends on the activity of the crystal and should be within -0.7 to -2.0 volts.

e. Verify that all the crystals are operating within the required range by rotating unit megacycle knob through all positions and observing VTVM. If all crystals are not oscillating re-adjust the core of L-217.

f. Connect the input of the VTVM through a 100K isolating resistor to pin 9 of thenth-megacycle oscillator tube, V204B.

g. Verify that all tenth megacycle crystals are oscillating by rotating fractional megacycle knob through all positions and observing VTVM. Reading on VTVM should be between -1.5 and -2.5 vdc for all positions of the switch.

4.11.3 Fixed I-F Amplifier

a. Connect a 2.2K 1/2-watt resistor across each of the primary windings of transformers T202, T203, and T204.

b. Connect the VTVM to pin 1 of 2nd detector V206B.

c. Connect the signal generator (G.R. Model 1001-A or equivalent) to pin 2 of the 2nd Mixer V204A, and adjust the generator to 3.1 mc.

d. Adjust the receiver tuning dial to 120 mc.

e. Adjust the secondary cores of transformers T202, T203, and T204 for maximum indication on the VTVM, while reducing the signal generator output, if necessary to keep the VTVM reading on scale.

f. Remove the 2.2K resistors from the primaries of the transformers, and connect them across the secondary windings.

g. Adjust the primary cores of transformers T202, T203, and T204 for maximum indication on the VTVM.

h. Remove the 2.2K resistors.

4.11.4 Variable I-F Amplifier

a. Connect the VTVM to pin 1 of the 2nd detector V206B.

b. Connect an H-P Model 608D signal generator or equivalent to pin 2 of 1st mixer V202A, and adjust the generator to 20.2 mc.

c. Adjust the receiver tuning dial to 120.2 mc and adjust the core of coil L205 for maximum indication on the VTVM, while reducing the signal generator output if necessary to keep the VTVM reading on the -3 volt d-c scale.

d. Adjust the signal generator to 20.7 mc and the receiver tuning dial to 120.7 mc, and adjust the core of L206 for maximum indication on the VTVM.

e. Adjust the signal generator to 20.4 mc and the receiver tuning dial to 120.4 mc, and adjust the core of transformer T201 for maximum indication on the VTVM.

4.11.5 R-F Amplifier and 1st Mixer

a. Connect the VTVM to pin 9 of the 2nd detector V206B.

b. Adjust the receiver tuning dial to 108.5 mc.

c. Connect the output of the signal generator to the antenna input of the receiver, and adjust for a standard input signal of 108.5 mc.

d. Adjust the cores of L201 and L204 for maximum indication on the VTVM.

e. Check the receiver sensitivity at several points within the tuning range, re-adjusting L201 and L204 if necessary to give equal sensitivity throughout the band.

MOTOROLA AVIATION ELECTRONICS, INC.
MAINTENANCE MANUAL ADDENDA
LNC-100 SYSTEM MANUAL

ADDENDUM NO. 8
DWG NO. 715052
ISSUE K

SUBJECT: Model 5611A VHF Receiver

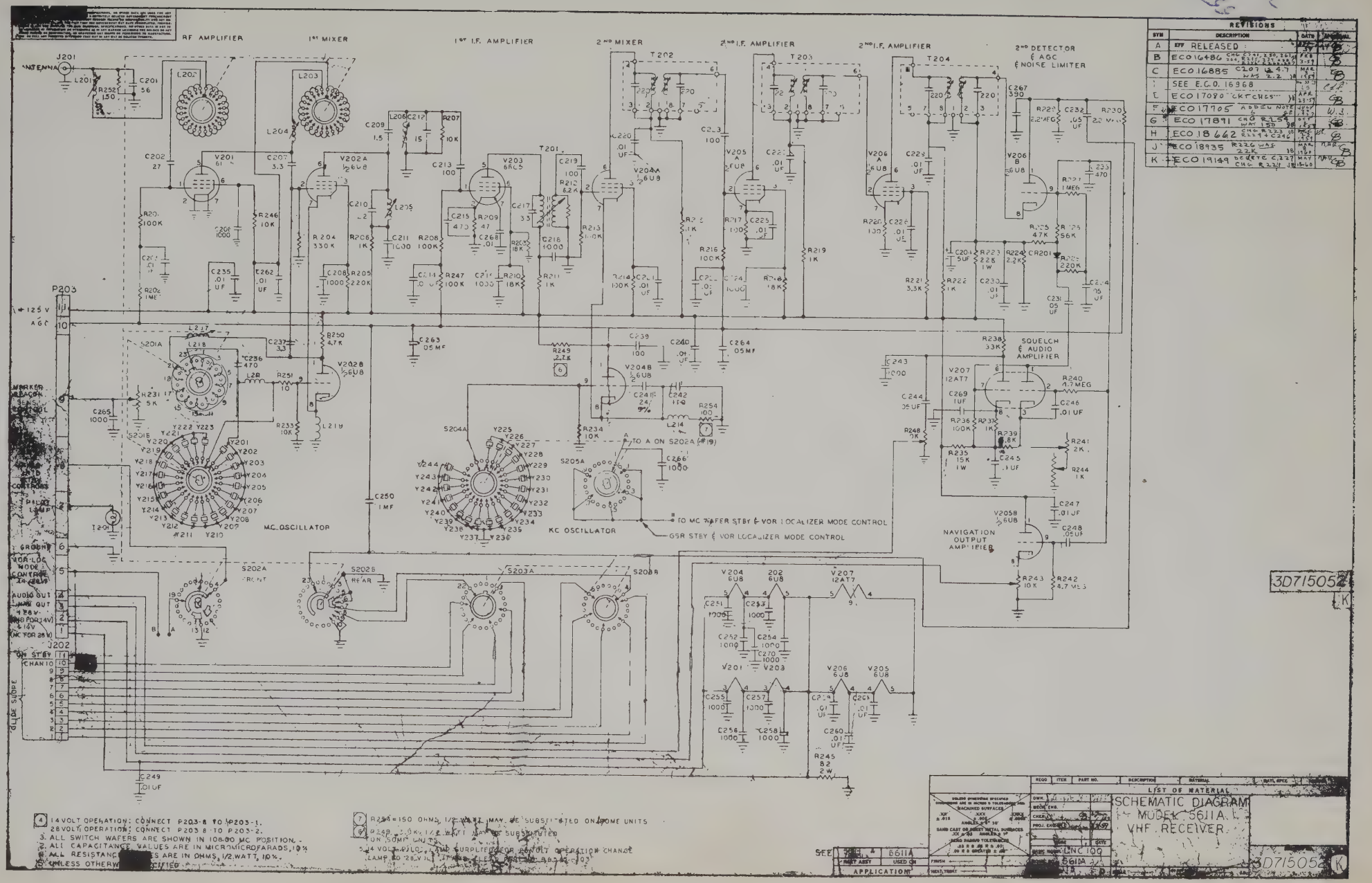
1. The circuit changes made on the Model 5611A VHF Receiver, issues F through K, are listed below. All other changes are noted on schematic 715052K.

Issue	Items Affected	Changes Made
F	C239	Decreased capacitance from 1000 uuf to 100 uuf.
G	C210	Increased capacitance from 20 uuf to 22 uuf.
G	C217	Increased capacitance from 30 uuf to 33 uuf.
H	R223	Decreased resistance from 470K ohms to 22K ohms.
H	R224	Decreased resistance from 33K ohms to 2.2K ohms.
H	C246	Decreased capacitance from .05 uf to .01 uf and re-wired as shown.
J	R226	Increased resistance from 22K ohms to 56K ohms.
K	Three 100K resistors in i-f amplifier cans	Deleted from T202, T203, and T204 between pins 5 and 6.
K	R221	Decreased resistance from 18K ohms to 3.3K ohms.

SUPPLEMENTARY PARTS LIST

FOR MODEL 5611A VHF RECEIVER

Symbol No.	Part No.	Description
C210	S10041-PA-22K	Capacitor, Fixed, Ceramic Dielectric; 22 uuf ± 10%, 500 wvdc
C217	S10041-TB-33K	Capacitor, Fixed, Ceramic Dielectric; 33 uuf ± 10%, 500 wvdc
C239	S10041-SA-100K	Capacitor, Fixed, Ceramic Dielectric; 100 uuf ± 10%, 100 wvdc
R221	S11012-332K	Resistor, Fixed, Composition; 3.3K ohms ± 10%, 1/2w
R223	S11012-223K	Resistor, Fixed, Composition; 22K ohms ± 10%, 1/2w
R224	S11012-222K	Resistor, Fixed, Composition; 2.2K ohms ± 10%, 1/2w
R226	S11012-563K	Resistor, Fixed, Composition; 56K ohms ± 10%, 1/2w


RF AMPLIFIER
1ST MIXER
1ST I.F. AMPLIFIER
2ND MIXER
2ND I.F. AMPLIFIER
2ND I.F. AMPLIFIER
2ND DETECTOR & AGC & NOISE LIMITER
SQUELCH & AUDIO AMPLIFIER
NAVIGATION OUTPUT AMPLIFIER
MC OSCILLATOR
KC OSCILLATOR
TO MC TRANSFER STBY & VOR LOCALIZER MODE CONTROL
GSR STBY & VOR LOCALIZER MODE CONTROL
TO A ON S202A (#19)
REVISIONS
SCHEMATIC DIAGRAM
MODEL 561IA
VHF RECEIVER
3D71505
K
LIST OF MATERIAL
APPLICATION

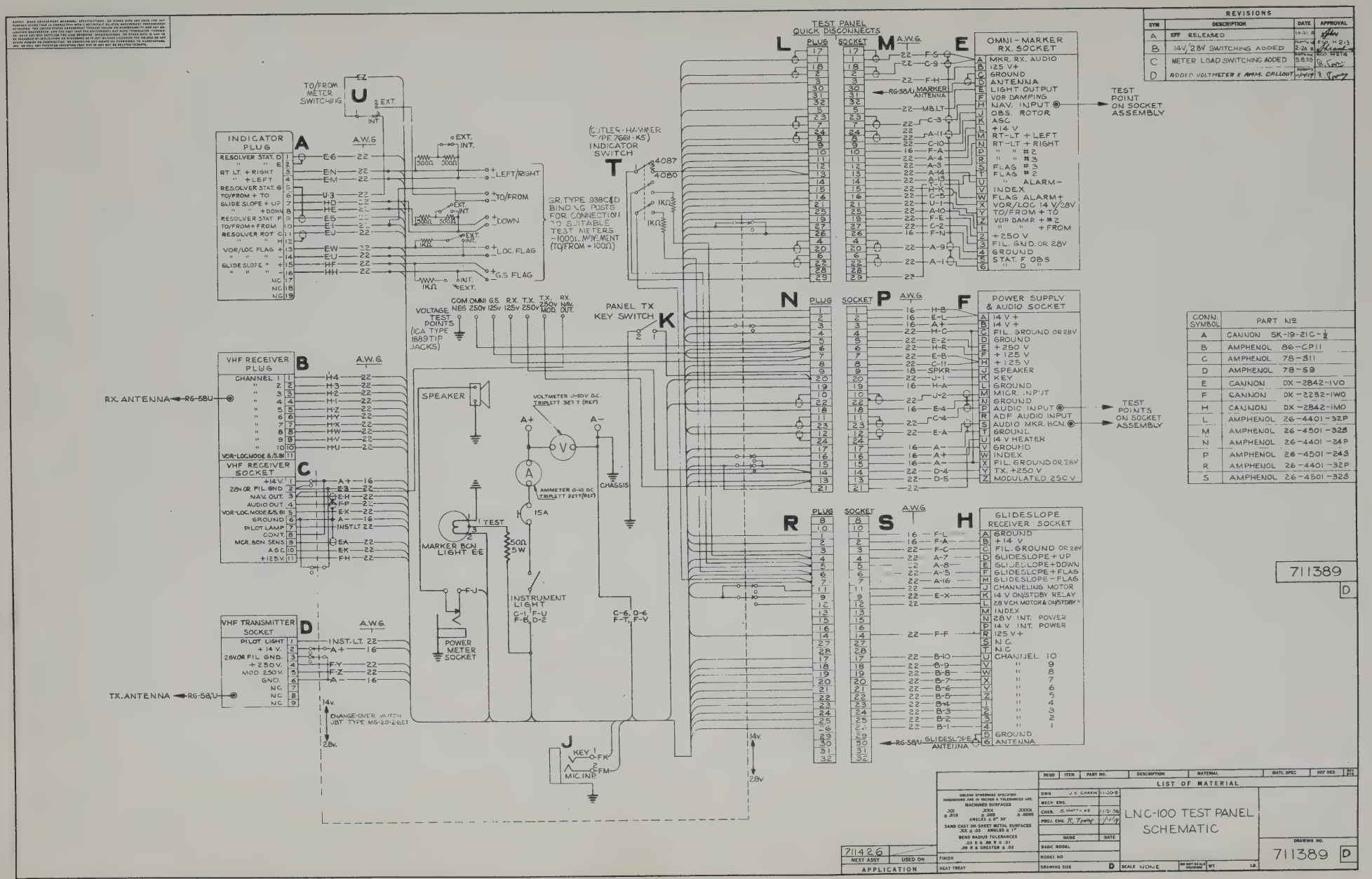
ADDENDUM NO. 9
DWG NO. S 711426B
711389P

SUBJECT: LNC-100 Test Panel

CHANGES:

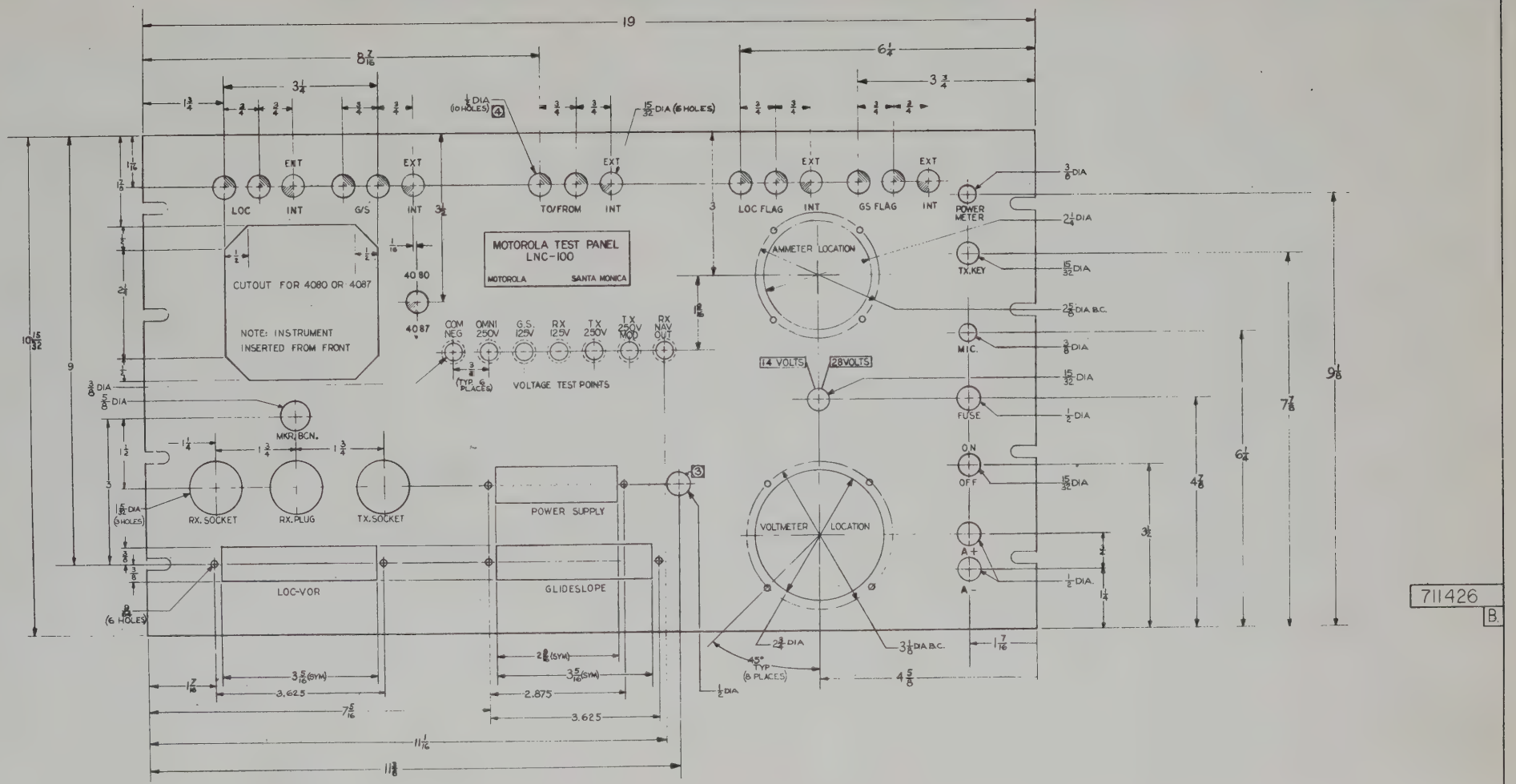
1. The LNC-100 Test Panel is not supplied by the manufacturer and therefore will have to be fabricated in the field.

2. Drawing No.s 711426 and 711389 provide the necessary instructions to fabricate the test panel.



December 8, 1960

Addendum No. 9



711426 B.

REV	CHANGE ORDER NO.	CHANGE	DATE BY	CHK.
A	–	RELEASE		
B	H301	CHGD. DIMS. TO STAND. PANEL		

6. METER CUTOUTS REFER TO METERS SHOWN ON SCHEMATIC DWG. 711389
5. PANEL LETTERING 1/8" LOCATED APPROXIMATELY AS SHOWN
4. TEN HOLES AT TOP OF PANEL ARRANGED FOR FIVE PAIRS OF GR TYPE 938C¢D BINDING POSTS MOUNTED ON GR TYPE 938-Z PLATES.
3. GROMMETED HOLE FOR LEADS TO INTERNAL POWER UNIT (IF FITTED).
2. SPEAKER MOUNTED INTERNALLY – ON SIDE OF CASE.

NOTES: 1. OVERALL DIMENSIONS OF PANEL MAY BE ADJUSTED TO SUIT LOCAL REQUIREMENTS.

REQD.	ITEM	PART NO.	DESCRIPTION	MATERIAL SPEC	VENDOR	PART No.
1	0	PWHA-12	PANEL BLANK		CALIF. CHASSIS CO	

MATERIAL: ALUMINUM 2024 T3
FINISH: TO SUIT LOCAL REQUIREMENTS
SCALE: FULL
DRAWN: MATTHIAS 2-26-58
CHKD: 2-27-58
DRAWING TITLE: PLATE - TEST PANEL LNC-100
DRAWING NO.: 711426
CATEGORY: D

ADDENDUM NO. 10
DWG NO. 715958
ISSUE D

SUBJECT: Model 5609B VHF Receiver

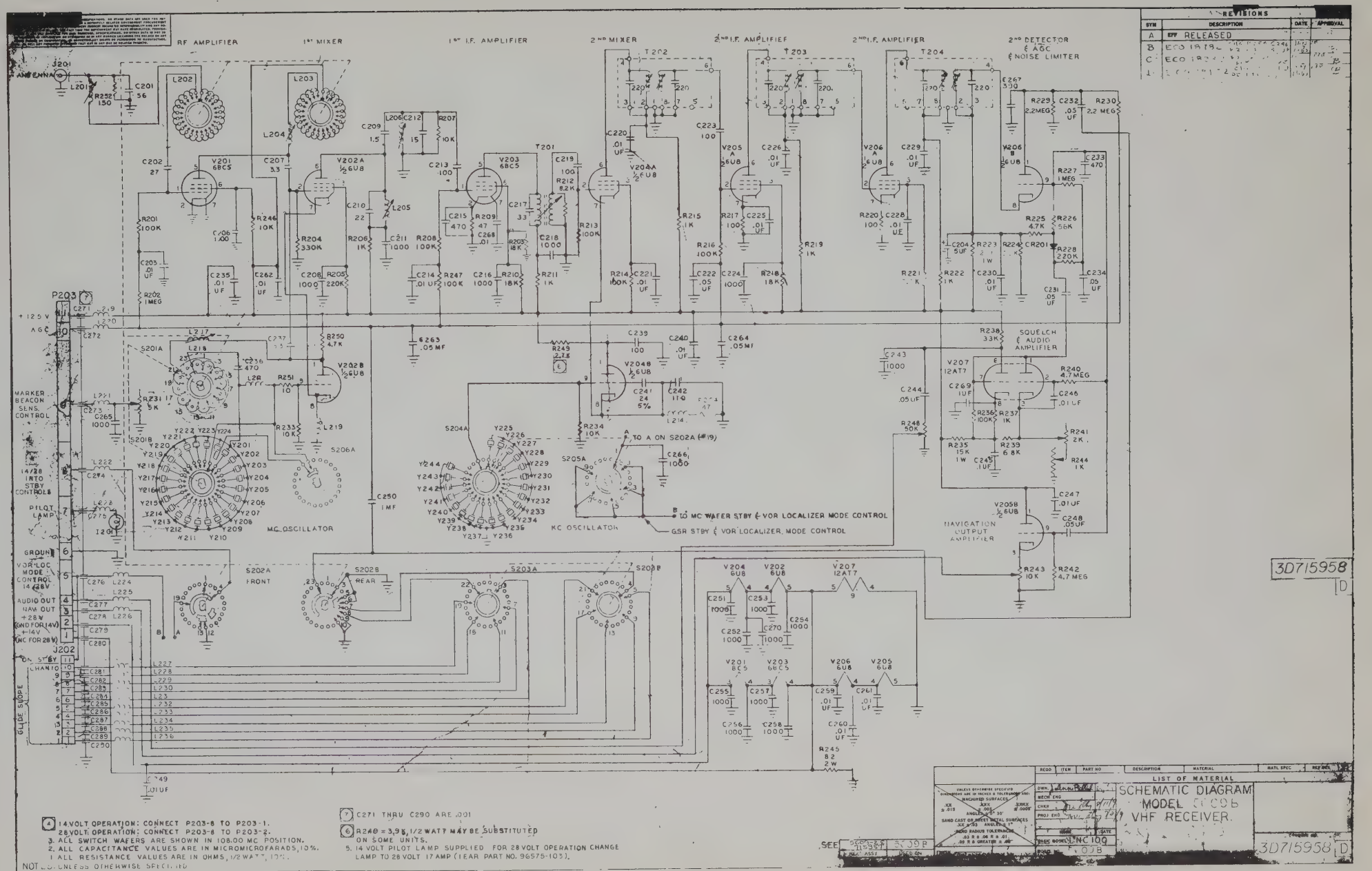
1. The circuit changes made on the Model 5609B VHF Receiver, issues B through D, are listed below. All other changes are noted on schematic 715958D.

Issue	Items Affected	Changes Made
B	R254	Decreased resistance from 150 ohms to 47 ohms.
B	R223	Decreased resistance from 470K ohms to 22K ohms.
B	R224	Decreased resistance from 33K ohms to 2.2K ohms.
B	C246	Decreased capacitance from .05 uf to .01 uf and rewired as shown.
C	R226	Increased resistance from 22K ohms to 56K ohms.
D	Three 100K resistors in i-f amplifier cans.	Deleted from T202, T203, and T204 between pins 5 and 6.
D	C227	Deleted.
D	R221	Decreased resistance from 18K ohms to 3.3K ohms.

SUPPLEMENTARY PARTS LIST

FOR MODEL 5609B VHF RECEIVER

Symbol No.	Part No.	Description
C246	90732-11	Capacitor, Fixed, Ceramic Dielectric; 19/32 OD disc, 0.01 uf +80% -20%, 600 wvdc
R221	S11012-332K	Resistor, Fixed, Composition; 3.3K ohms ± 10%, 1/2w
R223	S11013-223K	Resistor, Fixed, Composition; 22K ohms ± 10%, 1w
R224	S11012-222K	Resistor, Fixed, Composition; 2.2K ohms ± 10%, 1/2w
R226	S11012-563K	Resistor, Fixed, Composition; 56K ohms ± 10%, 1/2w
R254	S11012-470K	Resistor, Fixed, Composition; 47 ohms ± 10%, 1/2w


RF AMPLIFIER
1ST MIXER
1ST I.F. AMPLIFIER
2ND MIXER
2ND I.F. AMPLIFIER
2ND I.F. AMPLIFIER
2ND DETECTOR & AGC & NOISE LIMITER
REVISIONS
SYM DESCRIPTION DATE APPROVAL
A EFF RELEASED
B ECO 19786
C ECO 19822
ANTENNA
J201
L201
C201 56
R252 150
L202
L203
L204
V201 6BC5
V202A 1/2 6U8
V203 6BC5
V204A 1/2 6U8
V205 A 6U8
V206 A 6U8
V206 B 6U8
T201
T202
T203
T204
P203
+125 V
AGC
S201A
S201B
S202A FRONT
S202B REAR
S203A
S203B
MARKER BEACON SENS. CONTROL
14/28 INTO STBY CONTROLS
PILOT LAMP
GROUND
VOR-LOC MODE CONTROL 14 28V
AUDIO OUT NAV OUT +28V
(GND FOR +14V +14V (NC FOR 28V)
J202
ON STBY
CHAN 10
SIDE
MC OSCILLATOR
KC OSCILLATOR
S204A
S205A
S206A
TO A ON S202A (#19)
TO MC WAFER STBY & VOR LOCALIZER MODE CONTROL
GSR STBY & VOR LOCALIZER MODE CONTROL
SQUELCH & AUDIO AMPLIFIER
V207 12AT7
NAVIGATION OUTPUT AMPLIFIER
V205B 1/2 6U8
V204 6U8
V202 6U8
V207 12AT7
V201 6BC5
V203 6BC5
V206 6U8
V205 6U8
3D715958 D
LIST OF MATERIAL
SCHEMATIC DIAGRAM MODEL EC 096 VHF RECEIVER.
SEE 3C096P
3D715958 D
4 14 VOLT OPERATION: CONNECT P203-8 TO P203-1. 28 VOLT OPERATION: CONNECT P203-8 TO P203-2.
3. ALL SWITCH WAFERS ARE SHOWN IN 108.00 MC POSITION.
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, 10%.
1 ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.
NOTED UNLESS OTHERWISE SPECIFIED
7 C271 THRU C290 ARE .001
6 R248 = 3,9,5, 1/2 WATT MAY BE SUBSTITUTED ON SOME UNITS.
5. 14 VOLT PILOT LAMP SUPPLIED FOR 28 VOLT OPERATION CHANGE LAMP TO 28 VOLT 17 AMP (TEAR PART NO. 96575-103).

LNC-100

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ADDENDUM No. 11
DWG NO. 715861
ISSUE K

SUBJECT: Model 5611B VHF Receiver

CHANGE:

1. The Model 5611B (issue K) VHF receiver is identical to the Model 5611A (issue K) with the following exceptions:

   a. Standard type tubes, replaced with ruggedized types as indicated in Supplementary parts list, Addendum No. 11, page 2.

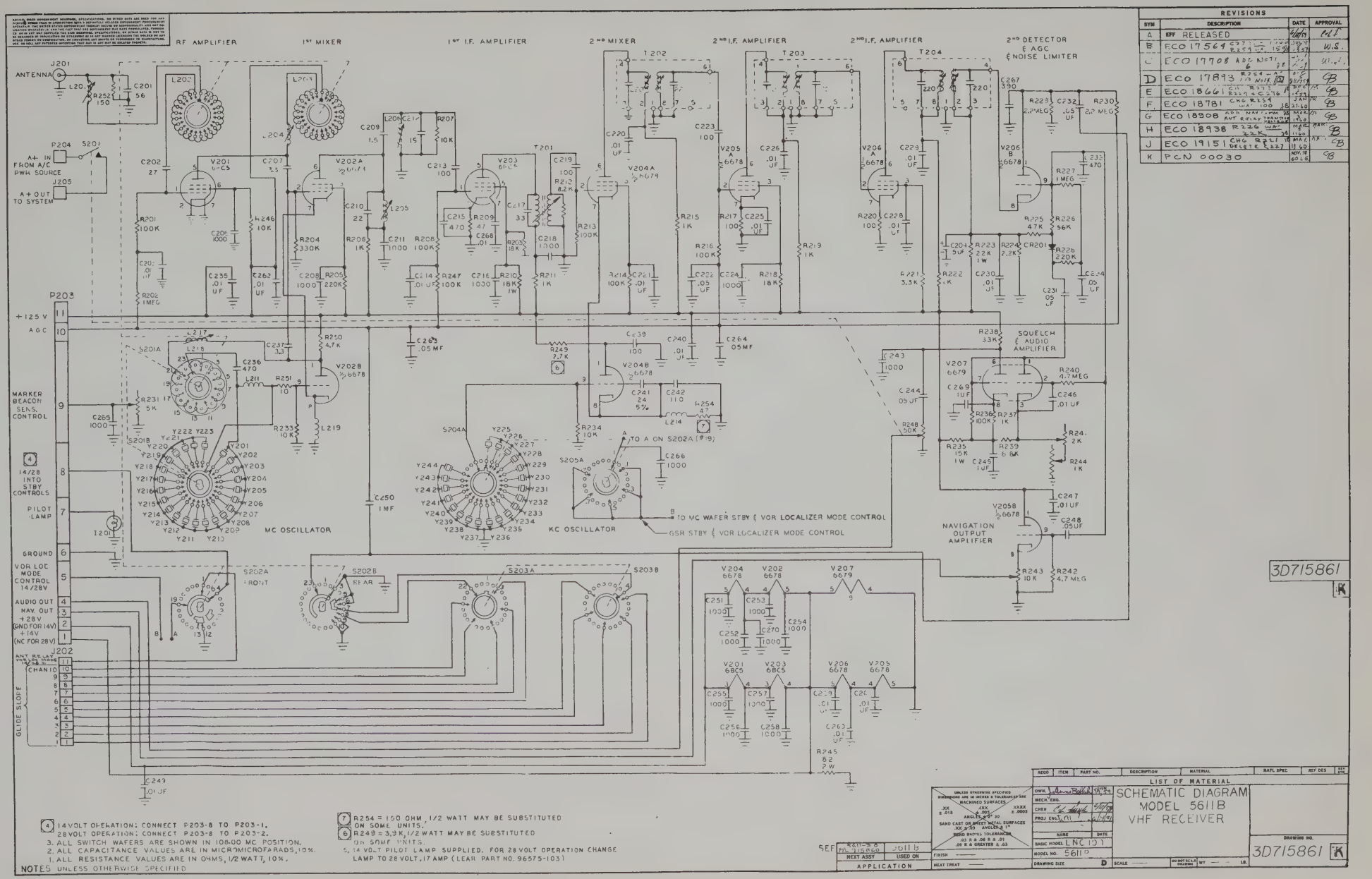
   b. ON-OFF switch S-206 added to potentiometer R-248.

ADDENDUM NO. 11
DWG NO. 715861
ISSUE K

MODEL 5611B

SUPPLEMENTARY PARTS LIST AND MODIFICATIONS

Symbol No.	Changes Made	New Part No.
S206	Added	S11036-02
V202	Replaced with 6678	S12000-062
V204	Same as V202	
V205	Same as V202	
V206	Same as V202	
V207	Replaced with 6679	S12000-062



REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	RELEASED		
B	ECO 17564		
C	ECO 17708		
D	ECO 17893		
E	ECO 18661		
F	ECO 18781		
G	ECO 18908		
H	ECO 18938		
J	ECO 19151		
K	PCN 00030	NOV. 18 60	

NOTES UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, 10%.
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, 10%.
3. ALL SWITCH WAFERS ARE SHOWN IN 108.00 MC POSITION.

4. 14 VOLT OPERATION: CONNECT P203-8 TO P203-1.
28 VOLT OPERATION: CONNECT P203-8 TO P203-2.

5. 14 VOLT PILOT LAMP SUPPLIED. FOR 28 VOLT OPERATION CHANGE LAMP TO 28 VOLT, .17 AMP (LEAR PART NO. 96575-103)

6. R249 = 3.9K, 1/2 WATT MAY BE SUBSTITUTED ON SOME UNITS.

7. R254 = 150 OHM, 1/2 WATT MAY BE SUBSTITUTED ON SOME UNITS.

SEE 5611-5-8 FOR 5611B

LIST OF MATERIAL								
REQD	ITEM	PART NO.	DESCRIPTION	MATERIAL	MATL SPEC	REF DES	ASY SYM

DWN.		
MECH. ENG.		
CHK		
PROJ. ENG.		
NAME	DATE	
BASIC MODEL	LNC 121	
MODEL NO.	5611B	
DRAWING SIZE	D	

SCHEMATIC DIAGRAM
MODEL 5611B
VHF RECEIVER

DRAWING NO. 3D715861 K

3D715861 K

ADDENDUM NO. 12
DWG NO. 717431
ISSUE A

SUBJECT: Model 5611C VHF Receiver.

CHANGE:

1. The Model 5611C (issue A) VHF Receiver is identical to the Model 5611B (issue A) with the following exceptions:

   a. Ruggedized type tubes replaced with standard types as indicated in the Supplementary Parts List, Addendum No. 12, Page 2.

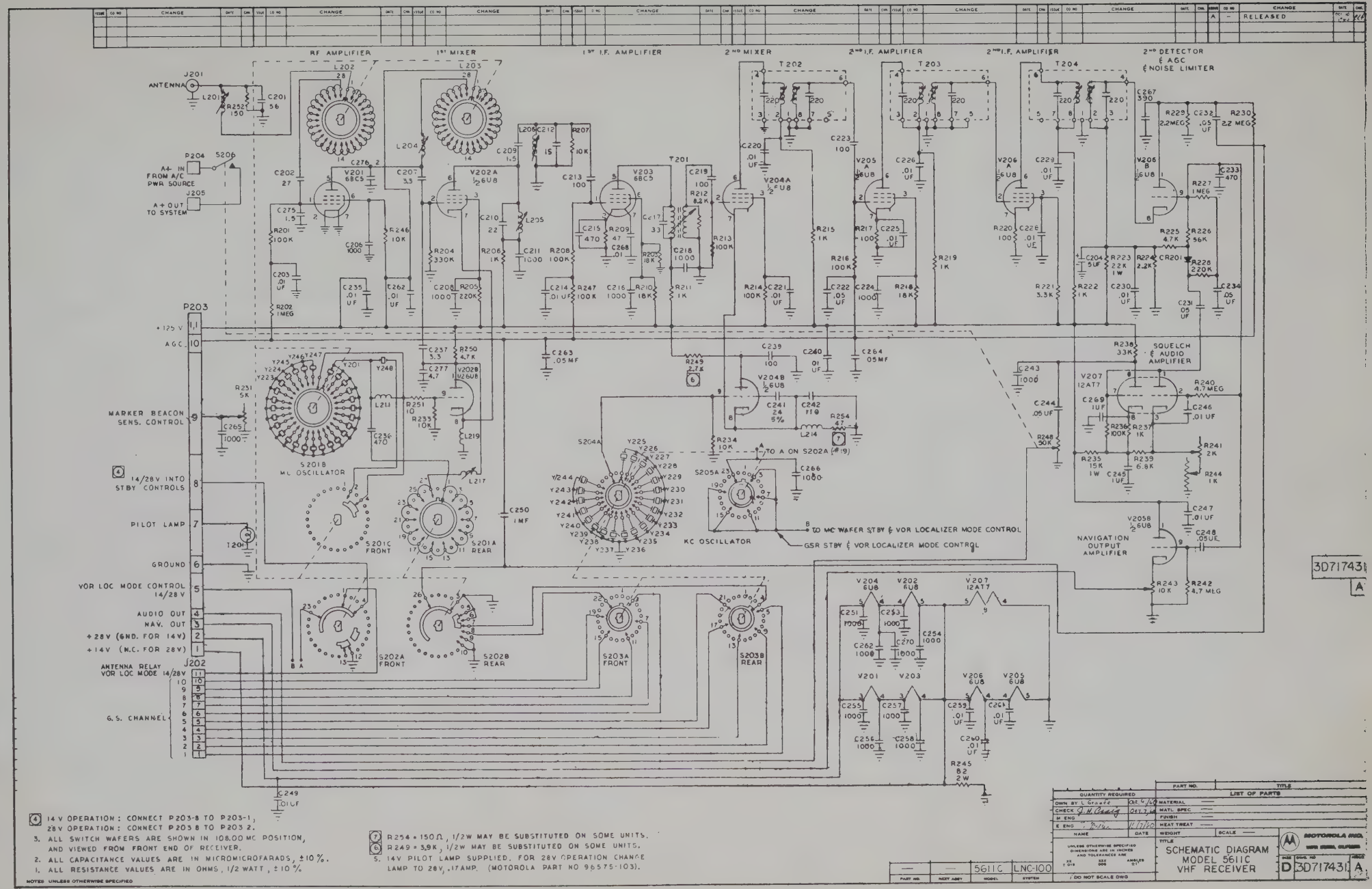
   b. Frequency range extended from 131.95 to 135.95 megacycles with 28 position crystal wafer switch and five additional crystals.

   c. De-coupling capacitor C-277 added in plate circuit of unit megacycle oscillator V-202B.

MODEL 5611C

SUPPLEMENTARY PARTS LIST AND MODIFICATIONS

Symbol No.	Changes Made	New Part No.
C277	Added	S10021-4R7-KM
S201B	Replacement	717815-01
V202	Replaced with 6U8	S12000-013
V204	Same as V202	
V205	Same as V202	
V206	Same as V202	
V207	Replaced with 12AT7	S12000-029
Y224	Added - 111.00 mc	713636-100
Y245	Added - 112.00 mc	713636-121
Y246	Added - 113.00 mc	713636-122
Y247	Added - 114.00 mc	713636-123
Y248	Added - 115.00 mc	713636-124



4. 14 V OPERATION: CONNECT P203-8 TO P203-1, 28 V OPERATION: CONNECT P203 8 TO P203 2.
3. ALL SWITCH WAFERS ARE SHOWN IN 108.00 MC POSITION, AND VIEWED FROM FRONT END OF RECEIVER.
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, ±10%.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ±10%

7. R254 = 150Ω, 1/2W MAY BE SUBSTITUTED ON SOME UNITS.
6. R249 = 3.9K, 1/2W MAY BE SUBSTITUTED ON SOME UNITS.
5. 14V PILOT LAMP SUPPLIED. FOR 28V OPERATION CHANGE LAMP TO 28V, .17AMP. (MOTOROLA PART NO 96575-103).

NOTES UNLESS OTHERWISE SPECIFIED

PART NO.	NEXT ASSY	5611C MODEL	LNC-100 SYSTEM

QUANTITY REQUIRED

DWN BY	L. Graefe	Oct. 4, 60
CHECK	J.H. Cassidy	Oct. 7, 60
M. ENG		
E. ENG		11/17/60
NAME		DATE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE: XX ± .01, XXX ± .005, ANGLES ± 0°1'

DO NOT SCALE DWG

PART NO. | TITLE: LIST OF PARTS

MATERIAL | MATL. SPEC | FINISH | HEAT TREAT | WEIGHT | SCALE

TITLE: SCHEMATIC DIAGRAM MODEL 5611C VHF RECEIVER

MOTOROLA INC. SYRACUSE, NEW YORK

SIZE D | DWG. NO. 3D717431 | REV. A

CHANGE	DATE	CHK	ISSUE	CO NO
RELEASED			A	--

ADDENDUM NO. 13
DWG NO. 715224
ISSUE G

SUBJECT: Model 5640B VHF Transmitter

CHANGE:

1. The Model 5640A1, B is identical to the Model 5640A (issue E) VHF Transmitter with the following exceptions:

   a. Circuit design changes have been incorporated to improve the reliability of the Transmitter.

   b. The circuit changes made are indicated in the Supplementary Parts List, Addendum No. 13, pages 2, 3 and 4.

   c. Refer to schematic diagrams 715224G (5640A1, B), 713410E (5640A) and Model 5640A parts lists located in the main section of this manual.

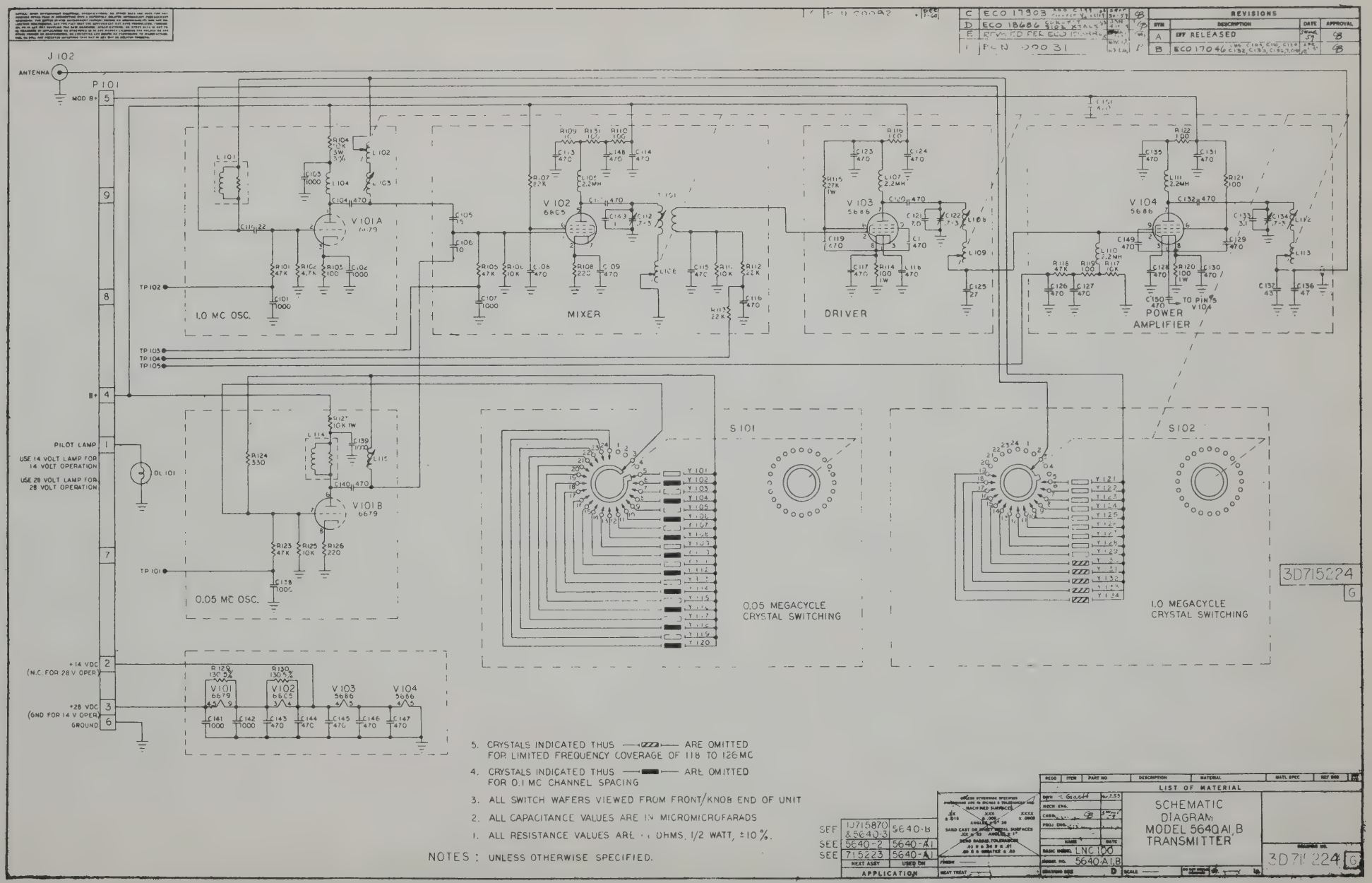
MOTOROLA AVIATION ELECTRONICS, INC.
MAINTENANCE MANUAL ADDENDA
LNC-100 SYSTEM MANUAL

MODEL 5640B

SUPPLEMENTARY PARTS LIST AND MODIFICATIONS

Items Affected	Changes Made	New Part No.
C104	Part Number	90732-01
C105	Part Number	S10041-CA15K
C106	Part Number	S10041-CA10K
C110	Changed from 500 uuf to 470 uuf	90732-01
C112	Changed from 0.7-3 uuf to 4-12 uuf	S10042-02
C120	Same as C104	
C121	Changed from 7 uuf to 4.7 uuf	S10041-CA4R7C
C129	Part Number	90732-25
C132	Same as C129	
C133	Deleted	
C135	Same as C129	
C136	Changed from 56 uuf to 47 uuf	S10041-TB47K
C137	Changed from 33 uuf to 43 uuf	S10041-UA-43K
C140	Same as C104	
C149	Added (Same as C104)	
C150	Added (Same as C104)	
C151	Added (Same as C104)	
C152	Added (Same as C104)	
C153	Added (Capacitor, Fixed, Ceramic Dielectric; 15 uuf ± 10% 500 wvdc)	705148-150KB
C154	Added (Capacitor, Fixed, Ceramic Dielectric; 0.001 uf ± 20%, 500 wvdc).	S10041-FB-1000M
C155	Added (Capacitor, Fixed, Ceramic Dielectric; 0.002 uf ± 20%, 500 wvdc)	
C156	Added (Same as C154)	
C157	Added (Same as C155)	
C158	Added (Same as C155)	
J102	Part Number	S24047-01
L101	Part Number	713621
L102	Part Number	705166-06
L103	Part Number	713626
L106	Part Number	717458-01
L108	Part Number	713625-02

Items Affected	Changes Made	New Part No.
L109	Added (Coil, Tapped Inductance Wafer)	717458-02
R104	Changed from 2.2k to 10k	S11006-D103J
R107	Changed from 22k to 82k	S11012-823K
R112	Part Number	S11012-223K
R113	Same as R112	
R115	Part Number	S11013-273K
R127	Part Number	S11013-103K
S101	Part Numer	715623-02
S102	Part Number	715623-01
T101	Part Number	713623-02
V101	Changed from 12AT7 to 6679	S12000-060



REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	ORIGINAL RELEASED		
B	ECO 17046 C132, C133, C135, C136		
C	ECO 17803		
D	ECO 18686		
E	REVISED PER ECO		
F	ECO 20031		

5. CRYSTALS INDICATED THUS —▨— ARE OMITTED FOR LIMITED FREQUENCY COVERAGE OF 118 TO 126 MC
4. CRYSTALS INDICATED THUS —▬— ARE OMITTED FOR 0.1 MC CHANNEL SPACING
3. ALL SWITCH WAFERS VIEWED FROM FRONT/KNOB END OF UNIT
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ±10%.

NOTES: UNLESS OTHERWISE SPECIFIED.

SEE	10715870 & 5640-3	5640-B
SEE	5640-2	5640-A1
SEE	715223	5640-A1
NEXT ASSY	USED ON	
APPLICATION		

LIST OF MATERIAL

SCHEMATIC DIAGRAM MODEL 5640A1,B TRANSMITTER

BASIC NUMBER LNC 100
SHEET NO. 5640-A1,B
DRAWING NO. 3D715224 G

ADDENDUM NO. 14
DWG NO. 717451
ISSUE B

SUBJECT: Model 5640B VHF Transmitter

CHANGE: The Model 5640C is identical to the Model 5640A1, B (issue G) VHF Transmitter, with the following exceptions:

a. Increased range of frequencies from 116.00 to 135.95 mc with provisions for the addition of six crystals, (Y-135 to Y-140).

b. Added filter (low-pass) in antenna circuit to attenuate any frequencies above 135.95.

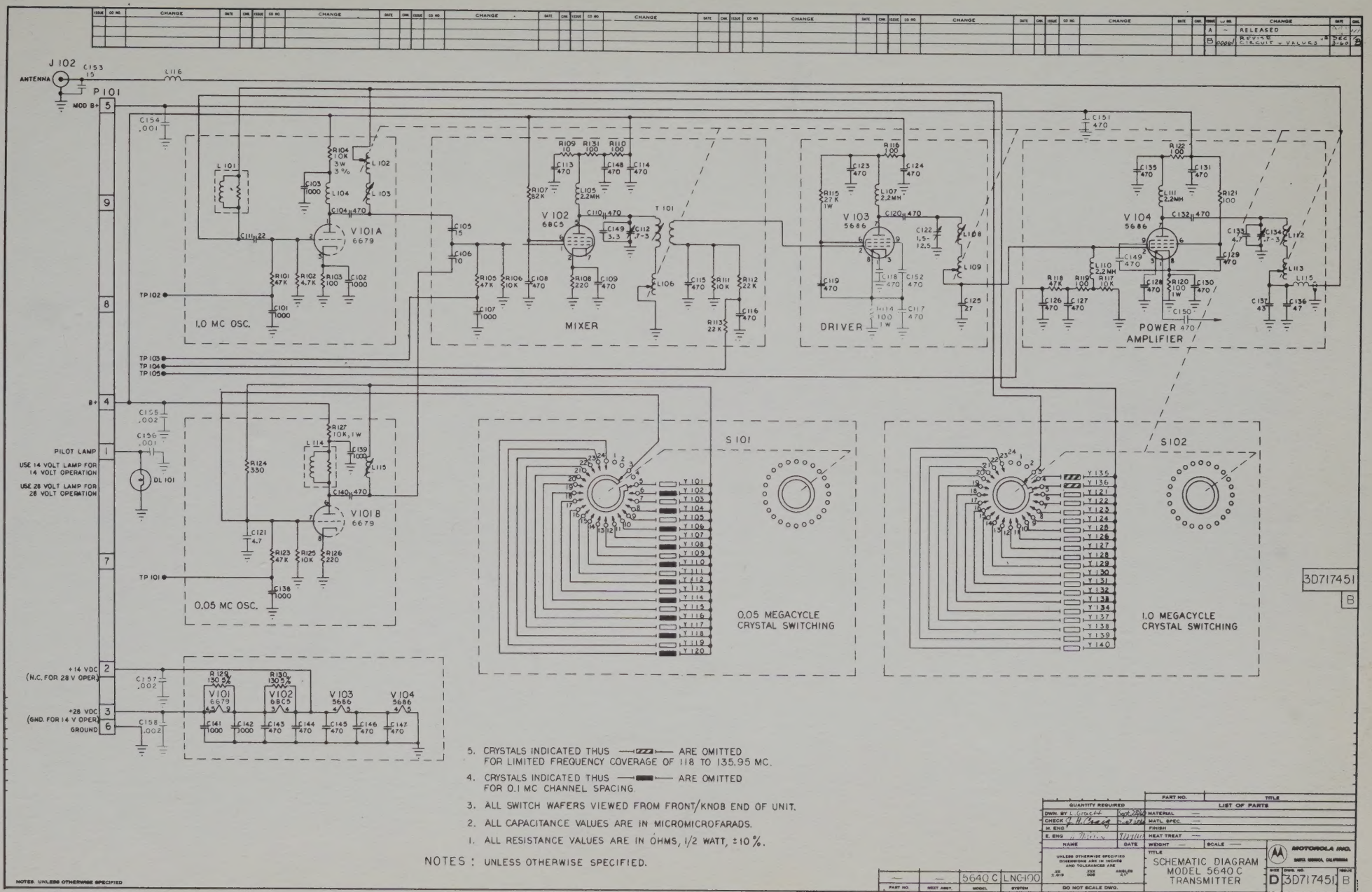
c. The circuit changes made are indicated in the supplementary parts list, addendum No. 14, page 2.

d. Refer to schematic diagrams 715224G and 717451B in the Addenda section of this manual.

MODEL 5640C

SUPPLEMENTARY PARTS LIST AND MODIFICATIONS

Items Affected	Changes Made	New Part No.
L116	Added (Choke, Low-pass filter.	717462-01
L117	Added (Same as L116)	
Y135	Added (Crystal, 80.00 mc)	713636-49
Y136	Added (Crystal, 81.00 mc)	713636-50
Y137	Added (Crystal, 96.00 mc)	713636-85
Y138	Added (Crystal, 97.00 mc)	713636-86
Y139	Added (Crystal 98.00 mc)	713636-87
Y140	Added (Crystal, 99.00 mc)	713636-88



5. CRYSTALS INDICATED THUS —▨— ARE OMITTED FOR LIMITED FREQUENCY COVERAGE OF 118 TO 135.95 MC.
4. CRYSTALS INDICATED THUS —▬— ARE OMITTED FOR 0.1 MC CHANNEL SPACING.
3. ALL SWITCH WAFERS VIEWED FROM FRONT/KNOB END OF UNIT.
2. ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS.
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ±10%.

NOTES : UNLESS OTHERWISE SPECIFIED.

NOTES: UNLESS OTHERWISE SPECIFIED

ISSUE	CO NO.	CHANGE	DATE	CHK.
A	–	RELEASED		
B	9088	REVISED CIRCUIT VALUES	3-60	

QUANTITY REQUIRED	PART NO.	TITLE
DWN. BY L. Crockett Sept 1960		LIST OF PARTS
CHECK J. H. Gard Oct 1960	MATERIAL	
M. ENG	MATL. SPEC.	
E. ENG H. Mitsuda 11/1/60	FINISH	
NAME DATE	HEAT TREAT	
	WEIGHT	SCALE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE: XX ±.010, .XXX ±.005, ANGLES ±1°. DO NOT SCALE DWG.

PART NO.	NEXT ASSY.	MODEL	SYSTEM
—	—	5640 C	LNC100

MOTOROLA INC. DATA SERVICE, CALIFORNIA

TITLE: SCHEMATIC DIAGRAM MODEL 5640 C TRANSMITTER

SIZE D | DWG. NO. 3D717451 | REV. B

ACCOPRESS®

NO. 2507

BF - RED	BS - TURQUOISE
BG - BLACK	BQ - PALM GREEN
BD - LT. GREY	BX - EXECUTIVE RED
BP - LT. GREEN	BZ - DARK GREEN
BU - LT. BLUE	BA - TANGERINE
BY - YELLOW	BB - ROYAL BLUE

SPECIFY NO. & COLOR CODE

ACCO DIVISION OF GARY INDUSTRIES, INC.
CHICAGO, ILLINOIS 60630